Enciclopedia en Español de Maquinaria para Minas, Pagina 60

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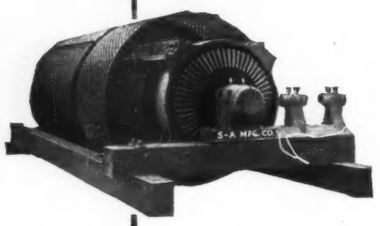

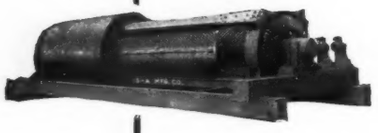

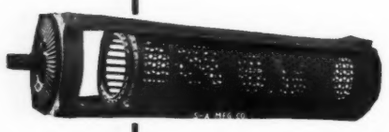

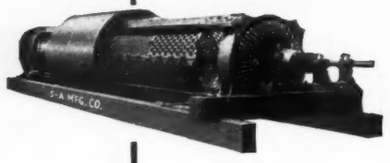

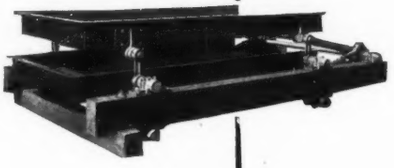

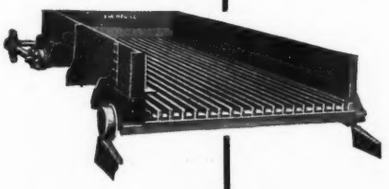

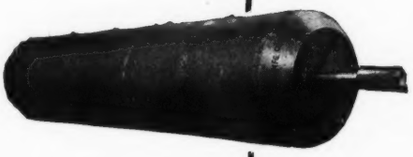

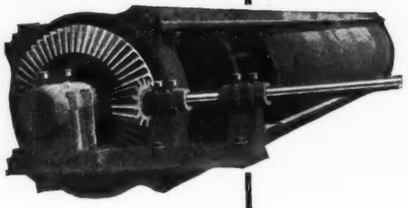

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Engineering and Mining Journal

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California Dredge with Four Tailings Conveyors

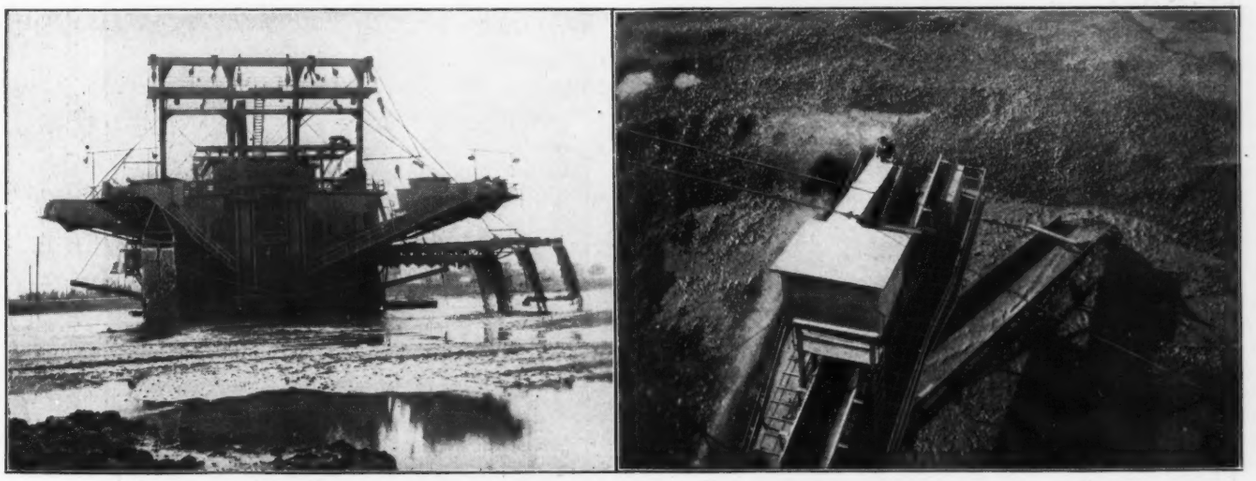
By Lewis H. Eddy*

SYNOPSIS—The problem of reclaiming dredged gold-placer ground for agricultural uses, coincident with recovery of the gold, is having a third practical demonstration in California in the operation of Natoma No. 1 dredge in American River district. This dredge operated about 8 years with single tailings stacker, placing the tailings in ridges, as is the common practice.

Reconstruction and equipment with four tailings conveyors of Natoma No. 1 dredge was begun Feb. 15 and finished Nov. 11, 1916. This is the second of the Natomas fleet of eleven dredges operating in the American River district, California, to be reconstructed and equipped for replacing the soil on top of the gravel and leaving the topography of the land unchanged, coincident with recovery of the gold. Natoma No. 4 dredge was reconstructed and equipped with two conveyors in 1915 and has since been improved in construction by adding chutes for handling the heavier gravel. No. 1 dredge is also provided with rock chutes for such pieces as it may be desirable to keep off the conveyor belts.

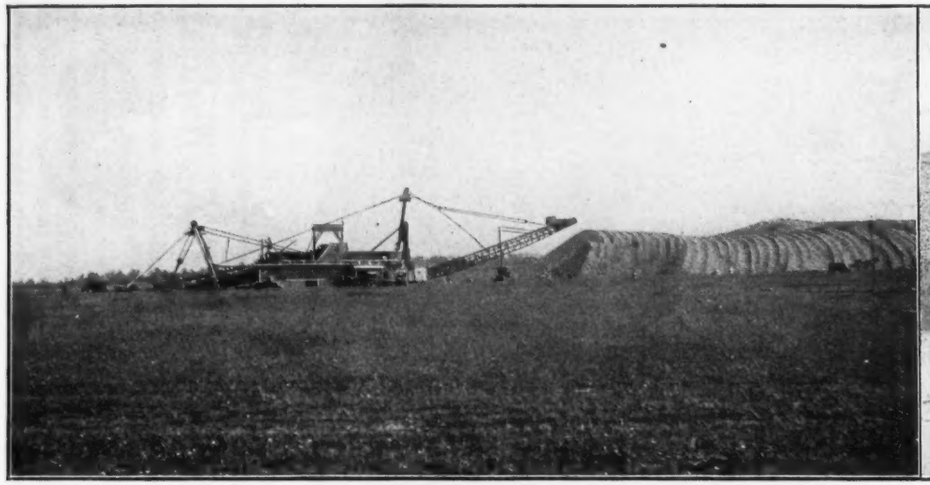
Both dredges operate in the Natoma field, south of the town of Natoma. No. 1 is on the west side of the Southern Pacific tracks and No. 4 on the east side. The ground in this section of the field slopes gradually from the hills on the northeast, to the American River, which flows southwest to its confluence with the Sacramento River at Sacramento.

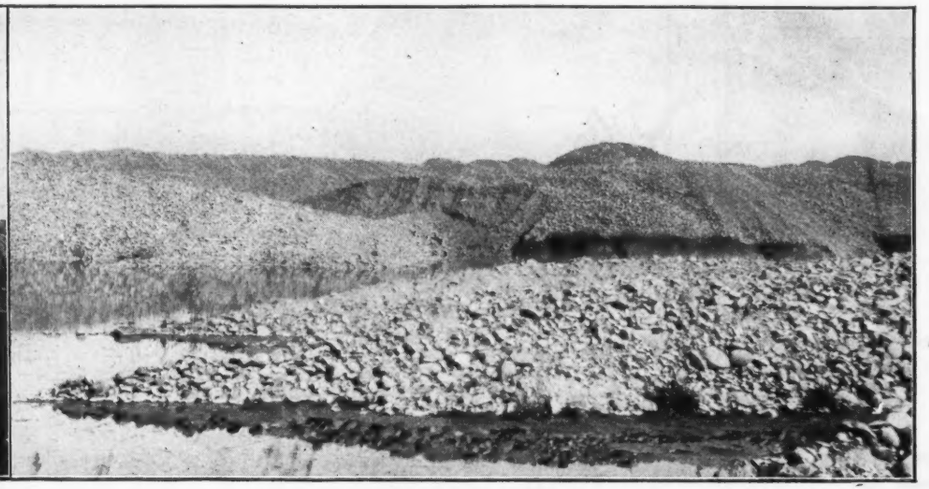
In the reconstructed dredge the length and width of the hull are increased, and in addition to the change in the tailings equipment is the substitution of a revolving screen for shaking screens and the lengthening of the digging ladder. The general equipment for disposing of the tailings is of the same type, design and construction as installed on Natoma No. 4 dredge. The rock is separated by means of a 4-ft. extension on the end of the revolving screen, which is perforated with 6-in. holes. As the material passes over this section, all the rocks under 6-in. size fall through the 6-in. perforations into a hopper, which divides them evenly to the small-rock conveyors. The rocks larger than 6 in. in diameter are carried to the end of the screen and deposited into another hopper, which divides them equally to the large-rock conveyors. The four tailings conveyors are made up of 18-in. channels, providing lightness with strength; the two tail sluices are made up of plates and angles. The large-rock, or upper, conveyors are each 56 ft. long, center to center of drums, and provided with 30-in. belts. The small-rock, or lower, conveyors are each 72 ft. 6 in. long, center to center of drums, and provided with 36-in. belts. The upper conveyors receive the rocks of 6-in. size and over and distribute them on the bottom of the pond.



STACKING TAILINGS, AMERICAN RIVER DISTRICT, CALIFORNIA
Showing distribution of tailings from four stackers. Upper end of conveyor

*Associate editor, San Francisco, Calif.

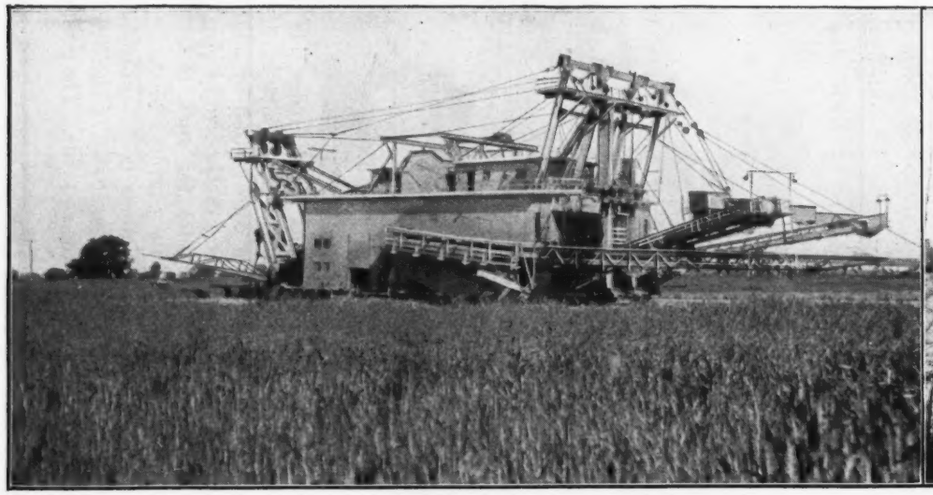




DREDGED GROUND, SHOWING THE RESULTS OF STACKING TAILINGS WITH A SINGLE CONVEYOR

View from undredged ground, soil of sufficient depth for the growing of grass for grazing purposes

View of ground in trail of dredge. Soil has not only been turned under, but apparently the larger rocks remain on top

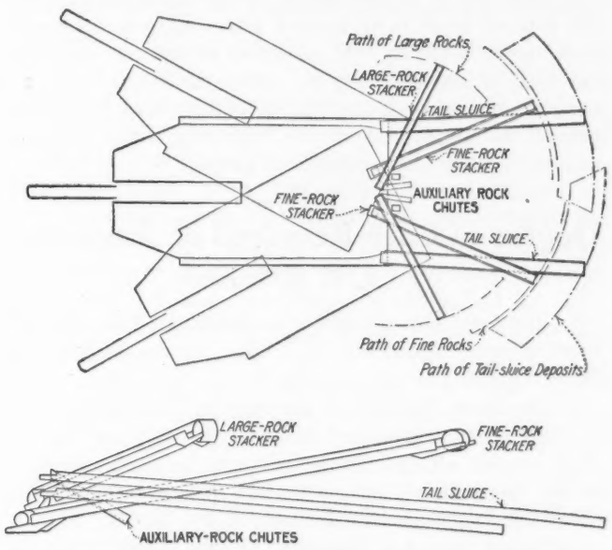


DREDGED GROUND, SHOWING THE RESULTS OF STACKING TAILINGS WITH FOUR CONVEYORS

View from undredged ground, which aside from its dredging value may have agricultural possibilities

View of young orchard, in trail of dredge, where soil is redistributed on top of boulders and gravel

These two conveyors are stationary and have a slope of 2½ in. in 12 in. The lower conveyors, receiving all rocks and gravel less than 6-in. size, distribute the material on top of the discharge from the upper conveyors, as the dredge moves forward. The lower conveyors are set in structural-steel footings on the deck floor, with provision for horizontal and vertical adjustment. In addition to these conveyors there are two double-deck tail sluices, situated on the stern at the sides of the hull, adjustable



PLAN AND SECTION, SHOWING ARRANGEMENT OF FOUR-TAILINGS-STACKER DREDGE

in the same manner as the small-rock conveyors, having a slope of 1 in. in 12 in. The upper decks of the tail sluices are 88 ft. long, the lower decks 72 ft. long. All sand and water passes to the tail sluices and is distributed on top of the gravel that comes from the conveyors.

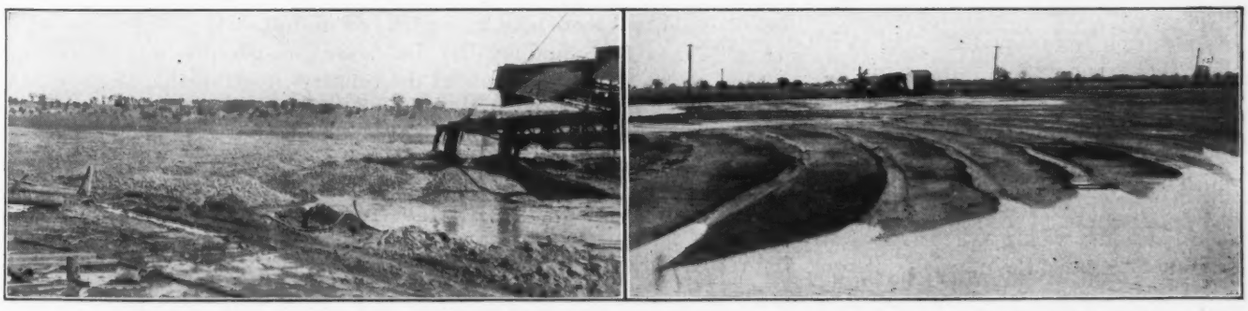
The diagram and the illustrations accompanying this article show the four-conveyor tailings equipment of Natoma No. 1 dredge. In the diagram the word "stacker" is used, being the common term applied to all dredge-tailings conveyors. But the word "conveyor" as used in the text is probably the more comprehensive, as this type of dredge does not "stack" the tailings.

The illustration of the port side of the reconstructed dredge, taken in March, 1917, shows the digging ladder working against a low bank of level ground and illustrates the arrangement and relative positions of the conveyors and tail sluices and also shows the even distribution of the tailings.

The illustration of the stern, taken on the same day as that of the port side, shows the tailings equipment, the stern gantry and the two spuds placed one on each side of the screen extension. The illustration of the upper end of the starboard upper conveyor shows the relative position of the starboard tail sluice.

The original Natoma No. 1 dredge began digging May 10, 1908, and in the period of 7 years 8 months handled a total of 23,642,200 cu.yd. of gravel, turning over 666 acres of ground. The wooden hull was 112 ft. long, 50 ft. wide, 11 ft. 6 in. deep. The plate-girder type digging ladder, 84 ft. long, was equipped with 13½-cu.ft. buckets, digging 35 ft. below the water line. The dredge was equipped with shaking screens and double-bank gold-saving tables provided with Hungarian-type wooden riffles. The tailings stacker was 104 ft. long, with 42-in. belt. The steel spuds were each 30 x 42 in. by 55 ft. long and each weighed 40,000 lb. It was at the time of its construction the largest-capacity gold dredge known. The dredge was electrically driven and required a total of 645 hp. No important changes in construction were made during the life of the original dredge; though the bucket capacity had been increased to 15 cubic feet.

The new wooden hull of Natoma No. 1 is 117 ft. long, 56 ft. wide, 11 ft. 6 in. deep. The digging ladder was lengthened to increase the digging depth from 35 ft. to 45 ft. It is steel plate-girder type, 96 ft. long, 5 ft. 2 in. wide, equipped with 67 California type two-piece 15 cu.ft. buckets made of manganese steel and weighing 3900 lb. each. The bucket pins are made of nickel chrome steel, 2 ft. 11 in. long, 6¼ in. in diameter; the bushings are of manganese steel. The ladder suspension is standard dredge type of upper and lower suspension blocks; the front hanger bar is solid eye-bar type; the back hanger is made up of 2¾-in. suspension-bridge cable, for flexibility. The lower tumbler is solid round manganese steel, with no wearing plates; tread, 5 ft. 6 in.; diameter, 45½ in. through the hub, outside diameter 7 ft. 7 in. Upper tumbler is standard one-piece carbon steel with manganese-steel cushion and manganese-steel ear plates. Both shafts are nickel steel. The bucket idler is one-piece type, of the same weight and dimensions as used on No. 4 dredge.



SURFACE AFTER DREDGING AND REFILLING WITH FOUR-TAILINGS STACKERS, AMERICAN RIVER DISTRICT, CALIFORNIA

The gantries are built of wood and extend through the deck to the floor of the hull, according to the usual practice in construction of wooden dredges. The bow gantry is made of 18 x 24-in. timbers, the stern gantry of 18 x 18-in. timbers. The revolving screen, which displaces the shaking screens of the old dredge, is 43 ft. long by 9 ft. in diameter. It is perforated with ⅜-in. holes

inside and ½-in. holes outside for the length of three sections, and ⅝-in. holes outside for the fourth section and 6-in. holes in the extension section. The distributor is of the same type as on No. 4 dredge, especially designed for good distribution. The saveall, grizzly, etc., are of the standard type.

The electric-motor equipment uses a total of 1000 hp.; it includes six operating and drive motors having a total of 475 hp. and five pump motors having a total of 525 hp. The main drive motor is 300 hp., 580 r.p.m.; swing winch, 50 hp.; screen, 75 hp., 580 r.p.m. three-phase 60-cycle 2000 volts variable speed; large-rock conveyors, 15 hp.; small-rock conveyors, 30 hp.; tool motor, 5 hp. The pumping equipment is composed of two 14-in. high- and low-pressure. Yuba pumps driven by 150- and 100-hp. motors; one 6-in. dual hopper, Yuba, 50 hp; one 6-in. two-stage Worthington fire, 75 hp.; one 10-in. dual monitor, Yuba, 150 hp. The electric power is furnished over pole line by the Great Western Power Co., of California. Transformers and safety devices are installed in accordance with the State Board of Fire Underwriters' schedule.

All the steel castings for new parts of machinery installed were furnished by the Columbia Steel Co.; the iron castings by the Stockton Iron Works. Most of the machining was done at the Natoma shops, except castings too large for the Natoma machines; the larger pieces were machined by the Union Machine Co., of San Francisco. The main drive, both winches and some of the other large pieces of machinery were taken from the dismantled dredge. The capacity of the reconstructed dredge is the same as that of the old dredge, and it will operate in ground of the same character.

"Liquid Fire" in the European War

The Germans have not hesitated to introduce any of the ancient or modern weapons of offense and defense which they thought would be of advantage, regardless of Hague conventions or accepted standards of civilization, says H. E. Howe in a bulletin of the American Chemical Society. Among these is "Liquid Fire," a weapon of value principally because of its demoralizing effect upon those attacked. There have been casualties resulting from liquid fire, but it is the psychological effect that is sought.

The apparatus usually consists of a metal tank holding about 4 gal. of liquid to be burned, a section of pipe from this tank to a rubber hose at the other end, in which there is a smaller metal pipe about a yard long fitted with a nozzle and a friction igniter, as well as an oil-burning wick. There is a valve near the tank and another near the nozzle. Benzol, from coal tar, and crude oil are used in equal proportions and are carried in the tank under a pressure of approximately 300 lb. per sq. in., this pressure being maintained by compressed nitrogen, an inert gas having no effect upon the contents of the tank. The tank and accessories are carried by one man, while the nozzle is carried by a companion when liquid is being burned. Or it may be fixed in position and operated by the same man who carries the tank.

In use a cap is drawn from the end of the nozzle and a wick burning kerosene or similar oil is thereby lighted, since the cap is a friction igniter. The oil is then turned on and is ignited as it leaves the nozzle under great pressure. The result is a flame of burning oil about 30 yd. long. For two-thirds of this distance the flame is straight, but it then turns up as does any other flame. It may be directed against the ground, but care must be taken not to deflect it too sharply as it may strike the ground and turn back toward those operating the device. It is therefore not well suited to turning down into a trench.

It is said by an expert that liquid fire is not so effective now that it is understood by the troops and means for defense have been worked out. It can be readily understood, however, that a number of such devices, with the roar of the escaping oil, when used together, gave a means of demoralizing the defenders of a trench, especially at night, and in the beginning was a valuable accessory, especially by raiding parties.

Degree of Care Required of Employers

By A. L. H. Street*

In the late case of Lively vs. American Zinc Co., 191 Southwestern Reporter, 975, the Tennessee Supreme Court applies the mine safety law of the state.

While being hoisted on an elevator in a mine shaft, a miner became faint and fell over one edge, owing to a chain on that side of the car being unfastened. Timbers in the shaft drew him from the elevator, and he was killed by falling to the bottom of the shaft. His administrator sued for damages, relying upon a violation of the state statute that requires hoisting machinery to be kept in safe condition.

Affirming the ruling of the trial court that the accident was not due to defendant employer's fault, the Supreme Court holds that where specific safety requirements are made by law, they must be absolutely complied with; approximate compliance is insufficient; but that the requirement in the Tennessee statute for "safe" hoisting machinery leaves it to a mine operator to install reasonably safe appliances, tested by the degree of care usually exercised by operators in general under similar circumstances. If he selects a type of machinery in general use, he cannot be deemed to be negligent, because there may be a safer type in use.

Finding that the elevator in question was of the kind used throughout the country in well-managed mines, the court holds that defendant sufficiently complied with the law.

Sundry Minerals in Japan

According to a consular report from Yokohama (*Commerce Reports*, May 18, 1917), the following rare metal ores were produced in Japan in 1916, the figures for 1915 being given in parentheses: Antimony, 27,333,333 lb. (18,490,615); molybdenite, 74,167 (24,733); tin, 562,-666 lb. (759,325); tungsten, 1,358,333 lb. (827,950).

Exports were as follows: Antimony, 19,978,643 lb. (19,209,472); tungsten, 1,194,933 lb. (1,074,800). Molybdenite exports in 1916 are not reported, but in 1915 they amounted to 16,400 lb.

The average metal content in the molybdenum ore was 40%; in tin ore, 40%; in antimony, 60%; and in tungsten, 60 to 65%.

*Attorney at law, 829 Security Building, Minneapolis, Minn.

The Metallurgy of Ferrosilicon*

SYNOPSIS—The rôle of ferrosilicon in steel metallurgy is second in importance to that of ferromanganese. It is used as a deoxidizer, promotes soundness in ingot iron and reduces porosity and segregation. Its metallurgy is described and its uses detailed.

In the metallurgy of iron and steel, ferrosilicon is second in importance only to ferromanganese from the standpoint of tonnage consumed. It is a singular fact that although electric-furnace ferrosilicon was first manufactured in the United States in 1898, it remained for European metallurgists, and particularly P. Girod, to develop its production on a large scale. Many plants are in operation on the continent of Europe, but until after the present war started there was but one large producer in the United States—the Electro Metallurgical Co., with plants at Niagara Falls, N. Y., and Kanawha Falls, West Virginia.

Almost any alloy of iron and silicon is called ferrosilicon. Typical analyses of ferrosilicon, which have been used in the metallurgy of steel either for purposes of

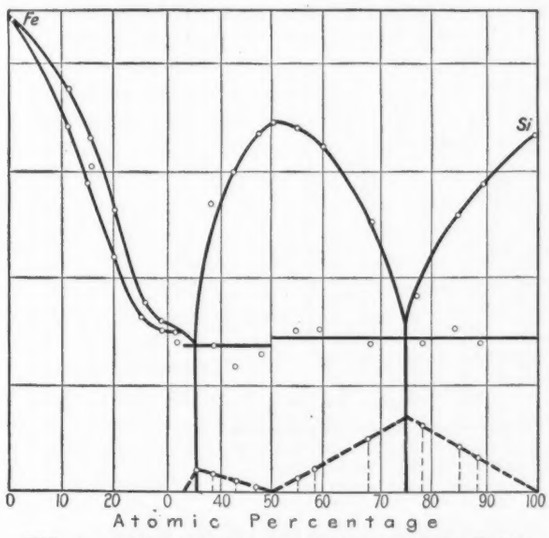


FIG. 1. EQUILIBRIUM DIAGRAM OF THE IRON-SILICON SYSTEM

deoxidation of liquid metal or for fixed addition in the metallurgy of silicon steels, are given in Table I. Ferrosilicon is invariably crystalline in structure, and it may be coarsely or finely crystalline, depending upon the silicon content. The silicon content of an alloy may be roughly judged by the appearance and color of the fractured surface. When the silicon content is less than 20%, the fracture appears finely crystalline but somewhat dull; with increasing percentages up to 30, the crystallization is platelike or slaty and the fracture brighter. Distinct crystallization is absent in the high-grade alloys over 50%, the fracture appearing fine, similar to elemental silicon, and the color bluish.

The iron-silicon alloys have been investigated thoroughly with the result that their properties are well understood. Tilden, Roberts Austen, and Turner began work with these alloys in 1887, and were followed by Hadfield in 1889, Baker in 1903, Guillet in 1904, Bisset in 1910, Paglianti in 1912 and Yensen in 1915. The metallography of the iron-silicon system has been dealt with in the scientific press by Osmond in 1890, Arnold in 1894, Baker in 1903, Gurtler and Tamman in 1905 and Gonterman in 1911. The last-named correlated the work of other investigators and plotted a diagram. There is considerable dispute as to the number of iron-silicon compounds, the number being held to be from two to five. Tamman and Gurtler show but two compounds, the silicides, Fe_2Si and FeSi. R. Frilley, in "Dingler's Polytechnisches Journal," Vol. 126, pp. 481-5, announces the existence of these silicides: Fe_2Si, FeSi, $FeSi_2$, Fe_2Si_3, Fe_3Si and Fe_3Si_4. Others point out the existence of Fe_3Si and $FeSi_3$. At least three compounds, Fe_2Si, FeSi and $FeSi_2$, exist and possibly some others.

The diagram of Tamman and Gurtler, shown in Fig. 1, indicates the existence of two eutectics; the first one contains 21.6% silicon and is composed of $Fe_2Si \div FeSi$, and the second one contains 60% silicon and is composed of $FeSi \div Si$. With less than 20% silicon present, the alloys are hard and massive and consist of solid solutions of Fe and Fe_2Si. With percentages of silicon from 20 to 21.6 the alloys are composed of crystals of primary Fe_2Si embedded in a matrix of the eutectic, $Fe_2Si \div FeSi$. When the percentage of silicon is between 21.6 and 33.3, the alloys consist of FeSi and the eutectic just mentioned. Crystals of FeSi are observed in the eutectic $FeSi \div Si$, when the silicon ranges from 33.3 to 60%. For percentages of silicon from 60 to 100, silicon crystals are found in a matrix of the eutectic, $FeSi \div Si$.

Chemical Properties

The impurities present in electric-furnace ferrosilicon are largely a function of the impurities present in the raw materials charged, hence it is important to obtain the purest materials available for charging. In the electric-furnace product, manganese is generally low, ranging from 0.10 to 0.40%, phosphorus from 0.01 to 0.05%, sulphur from 0.01 to 0.05%; and carbon from nil to 0.30%. The percentages of impurities are dependent upon the grade of the alloys made, and in general, the higher the grade the lower the impurities. In blast-furnace ferrosilicon, manganese ranges from 1.25 to 2.5%, phophorus is usually less than 0.06%, sulphur less than 0.05%, and carbon may vary from 1 to 2%. In the 25% grade, calcium may be about 0.5%, and it increases up to 1% in the 90% grade. Aluminum in most grades will be around 0.1%.

Frilley has investigated the manganese-silicon alloys, both as to properties and constitution, and has shown that in this system that the following silicides are present: $SiMn_2$, SiMn, Si_2Mn, Si_2Mn_3 and $SiMn_5$. Ferrosilicon-aluminum is an alloy containing about 45% silicon, 12 to 15% aluminum and the remainder iron. It is employed as a deoxidizing agent. This alloy is used mainly in steel made in the electric furnace to scavenge out oxides from the metal and produce easily fusible silicates of iron and aluminum. It is added to the liquid steel

*Excerpts from an article by Robert J. Anderson, in "Iron Trade Review, May 10, 1917, by courtesy of the publishers.

in the ladles before the metal is teemed into molds, so that any tendency toward wildness on casting will be overcome. The function of ferrosilicon-aluminum is virtually the same as that of aluminum, but it appears to be more effective.

Ferrosilico-manganese is made in two compositions in a French works; these are, 60 to 70% manganese, 20 to 25% silicon and 3 to 4% iron; and 50 to 60% manganese, 22 to 25% silicon and about 19% iron. The carbon in both is about 0.35%, and phosphorus and sulphur are quite low. Either of these alloys is at times employed for fixed additions to liquid steel.

Ferrosilico-manganese-aluminum is made in two grades as follows: 18 to 20 or 9 to 11% silicon, 18 to 22 or 9 to 11% manganese and 9 to 12 or 4.5 to 6% aluminum. Ferrosilico-calcium-aluminum has an average composition of 50 to 55% manganese, 18 to 22% calcium, 12 to 15% iron, 4 to 5% aluminum and about 1% carbon. Its use is limited to the manufacture of high-grade steels that can stand the cost. This alloy is both a deoxidizer and a desulphurizer. Silico-spiegel contains from 22 to 24% silicon, and from 35 to 40% manganese. It is made by melting down ferrosilicon, flint, manganese ore and carbon. As this alloy is much higher in grade than the blast-furnace silico-spiegel, it finds considerable use in the metallurgy of manganese steels in works in England and Italy.

Ferrosilicon is made by two different methods, the blast furnace and the high-temperature electric furnace. The alloy is also produced from two different charges: First, by reducing silica and iron ore with carbon, and second, by the reduction of silica with carbon, the iron addition being in the form of turnings. Although the idea of utilizing iron-silicon slags has been proposed, it has not been employed commercially, and the experiments of R. M. Keeney indicate that such a method does not appear practical.

Blast-Furnace Manufacture

Ferrosilicon made in the blast-furnace stack contains 20% silicon and less, the electric furnace being employed for the production of the rich alloys. In general, blast-furnace ferrosilicons contain from 10 to 20% silicon, with an average of about 15%. The difficulty of securing high enough temperatures in the blast furnace militates against the production of the higher grade alloys; even in making 15% ferrosilicon, the fuel consumption is high.

TABLE I. ANALYSES OF FERROSILICON*

Kind of Alloy	Si	C	Mn	P	S	Fe
English blast furnace	8.10	1.75	2.20	0.056	0.045	87.80
English blast furnace	11.50	1.50	1.35	0.058	0.030	85.50
English blast furnace	13.45	1.21	1.71	0.058	0.020	83.50
English blast furnace	17.0	0.90	1.50	0.080	0.040	80.40
Electric furnace	32.70	0.27	0.31	0.050	0.040	66.60
Electric furnace	48.70	0.09	0.13	0.040	0.030	51.0
Electric furnace	75.80	nil	0.11	0.020	0.020	24.0
Electric furnace	94.80	nil	0.08	0.010	0.020	5.10

* "Foundry Trade Journal," 1907, p. 424.

The charge consists of iron oxide, siliceous iron ore and coke, the reduction being effected by the carbon. Slags high in alumina and correspondingly low in lime are reputed to be desirable, as the reduction is secured more readily by their use. The furnace operation does not differ materially from the usual practice when making pig iron, but continuity of running is interrupted by furnace difficulties. Depending upon the size of the stack used, the production will vary from 25 to 100 tons.

The early attempts to manufacture ferrosilicon in the electric furnace simultaneously with other products met with complete failure. Rathenau, Gin, Keller, Straube and others carried out pioneer work in ferrosilicon metallurgy. Straube, among other suggestions, proposed raising the silicon tenor of a low-percentage alloy by either remelting it and adding a charge of quartz and carbon or drawing it while liquid into another furnace and there adding quartz and carbon.

F. J. Tone, in an American patent, recommended the use of carborundum or siloxicon as a source of silicon for the raw-material charge. Carborundum is essentially silicon carbide, SiC. The Tone patent is based on the following formula:

$$Fe + SiC = (Fe + Si) + C$$

In modern electric-furnace practice, there are two kinds of charges that find application in the manufacture of ferrosilicon. These may be either wrought-iron, steel or cast-iron turnings, quartz or sand, and charcoal, coke or coal as a reducing agent; or silicious iron ore, quartz or sand, and charcoal, coke or coal, according to R. M. Keeney in Bulletin 77, United States Bureau of Mines. Iron turnings are generally preferable to iron ores, as the power consumption is less, the furnace operation is steadier and naturally there is less slag produced. In most operating plants the endeavor is to secure the purest raw materials available—the object in this being to avoid the introduction of slag-forming materials into the charge and also to prevent the presence of phosphorus and sulphur in the finished alloys. The reducing action of the procedure is so powerful that most of the phosphorus and sulphur present in the charge appears in the metal, a subordinate percentage appearing in the slag.

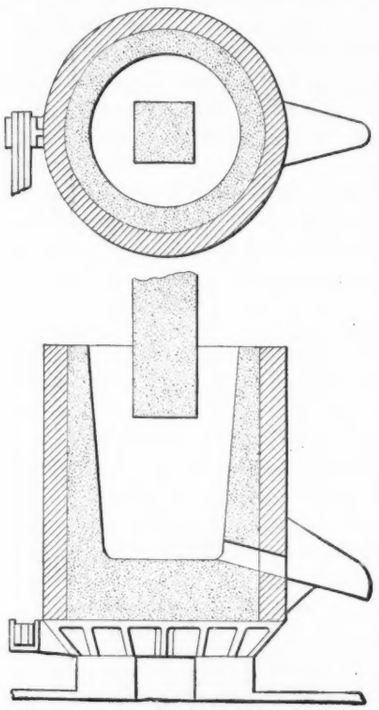


FIG. 2. PLAN AND ELEVATION OF SIEMENS TYPE OF FERRO-SILICON FURNACE

The charge of raw materials is thoroughly mixed, and then shoveled into the furnace top. The charging of furnaces is ordinarily done by hand, but a few establishments having large furnaces use an automatic charging arrangement, the salient feature of which is an inclined chute which discharges the raw material mixture into the furnace. The material should be distributed at intervals around the electrodes so that the latter are covered to a depth of about a foot. Power consumption and electrode loss are held down by covering the furnace top with cold material.

In electric-furnace practice for the production of ferrosilicon, the resultant alloy is tapped out at periodic intervals, say two hours or more, depending upon the

amount of silicon required in the alloy. As pure materials are used for the charge, but little slag is formed. When tapped, the metal and slag are run into iron cars lined with sand or carbon or into sand molds in the pit in front of the furnace. Because of the highly corrosive action of the metal at the pouring temperature, iron molds or ladles would have a short life, so that these are not used. After being run into the molds, the alloy is cooled and then broken into pieces of small size for packing and transport.

Fig. 2 illustrates a plan and elevation of a Siemens type of ferrosilicon furnace. This furnace has a circular cross-section. The power is conducted by one upper electrode, as shown, and a carbon hearth. The furnace used for electric ferrosilicon manufacture cannot be lined with fire brick because of the corrosive character of the alloy. Hence, carbon is used to cover any firebricks which may be employed. A furnace that has been put out for ferrosilicon manufacture and designed to avoid the use of a conducting hearth is shown in Fig. 3. This is a three-phase series furnace.

Cost of Production

For commercial purposes, iron-silicon alloys made in the electric furnace are in four grades, which are graded and marketed according to their silicon content; these grades contain 25 to 30%, 45 to 55%, 75 to 80% and 90 to 95% silicon and higher. Dr. W. Conrad has given a table showing the cost of making one ton of both 25 and 50% ferrosilicon at a French works. These costs are made up as shown in Table II.

Power is a considerable item of expense in all electric-furnace work, and particularly so in the United States, where the waterfalls have not been utilized as extensively as they have in France, Norway and Sweden. Where the cost of production may be from $25 to $50 abroad, depending upon power costs, raw material sources and grade of alloy made, in this country it will range from $40 to $65 a ton.

Installation of Plant

A ferrosilicon plant of 500-kw. capacity, which is an average size for an initial installation, will require from 8000 to 10,000 sq.yd. of floor space. As given by Harden, this is as follows:

	Sq.Yd.
(A) Storage:	
Storage for quartz	2,000
Storage for coal and coke	850
Storage for scrap iron	200
Storage for sundry requirements	200
Storage for finished products	300
Storage for electrodes	150
(B) Furnace Plant:	
Furnace room	850
Transformer room	300
Shop for electrode filling and repair shop	200
Crushing and mixing floor	300
(C) Sundry Floor Space:	
Breaking and packing room	400
Laboratory, office, workmen's room, etc	200
(D) Sidings and Factory Yard	3,000
Space should also be provided for future expansions.	8,950

TABLE II. COST OF MAKING ONE TON FERROSILICON

25% Silicon		50% Silicon	
1,600 lb. scrap iron	$11.60	1,000 lb. scrap iron	$6.86
1,600 lb. quartz	.75	6,000 lb. quartz	2.68
950 lb. coal	1.41	3,200 lb. coal	4.65
110 lb. of electrodes	4.32	200 lb. electrodes	8.00
Wages and salaries	6.60	Wages and salaries	17.20
Repairs, maintenance, etc	4.00	Repairs and sundries	15.00
General incidentals	1.40	General incidentals	2.80
Total	$30.08	Total	$57.19

The packing and transport of ferrosilicon, particularly those grades containing from 30 to 65% silicon, is a matter of importance, because of the cases of poisoning that have been traced to the disintegration of the alloys. This disintegration occurs in spots in a mass of the ferrosilicon, so that part of it remains firm and hard and the rest crumbles and falls away. There appears to be considerable diversity of opinion as to whether this falling away was traceable to certain physical or chemical conditions or was inherent. Keeney suggests that calcium may cause disintegration, while Frilley attributes it to aluminum. Others hold that the pouring temperature of the furnace operation and even the current density of the power line used are the causes. It seems that positive knowledge is wanting.

The gases evolved appear in many instances to be phosphine, PH_3, and arsine, AsH_3, irrespective of how they are caused. The raw materials entering into the furnace charge usually contain phosphorus in small amount at least, and the high reducing action of the manufacturing process concentrates this element in the alloy. The grinding of the pieces in transport and any exposure of the resultant powder to a humid atmosphere gives rise to the gases mentioned. Even small amounts of phosphine are highly harmful. Hence it is better practice to pack the alloy in lead or iron-lined boxes; in fact, in some countries laws have been passed to this effect.

Alloys containing less than 30% silicon do not exhibit the strong tendency toward spontaneous disintegration that the alloys containing from 30 to 65% silicon do. The former are hard and compact, but the latter may crumble to pieces on standing. The disintegration is concomitant with the evolution of odoriferous and poisonous gases. The richer alloys, containing more than 65% silicon, are somewhat hard and brittle and do not disintegrate spontaneously.

Ferrosilicon is used mainly for the deoxidation of steel. According to Thomas Turner it is probable that the first intentional addition of silicon to steel was made by Sir Henry Bessemer, who stated in 1861 that a small amount of silicon in steel prevented ingots from being porous or cellular. Many observations were made in the following 25 years, and in 1887 Turner arrived at some general conclusions, which for brevity may be summed up as follows: Silicon promotes soundness in ingot iron, resembling the action of carbon in producing tenacity and hardness; it should not exceed 0.15% in metal which is to be rolled; about 0.3% silicon is generally recommended to promote soundness in steel castings; manganese is capable of neutralizing some of the ill effects due to silicon, and it is probable that the presence of carbon is detrimental to silicon steel.

In general, silicon produces soundness in cast steel and is largely used in the manufacture of basic openhearth steel. The statement of Sir Robert Hadfield, that silicon up to 1.75% increases the yield point and tensile strength but does not diminish the ductility, but beyond that point any increase of tenacity is accompanied by a great loss of ductility, is widely accepted.

Used as a Deoxidizer

Ferrosilicon, as already mentioned, is used as a deoxidizer and quieter in the metallurgy of steel; the result of the reaction is either silica or silicates with any free oxygen or oxides in the metal, the products of the reaction going to the slag. The grade containing from 25 to 30%

silicon is used for direct addition to the converter, open-hearth, cupola, or ladle for the purpose of making fixed additions for silicon steel. The 45 to 50% grade is used mainly for deoxidation of metal, and it consequently follows that more of this alloy is used than any other of the iron-silicon alloys.

When added to steel baths, silicon reduces porosity and honeycombing, as well as segregation. Used in excess, it forms a large pipe in cast ingots. Ferrosilicon is of greater value in the iron foundry than in steel practice.

The properties of ferrosilicon that make it of high value in steel-works practice make it of even greater value to the iron founder. The effect of silicon on cast iron has been the subject of considerable investigation, particularly by A. E. Outerbridge, Jr. The fact has been well established that high silicon will prevent the formation of combined carbon with the consequent production of graphite, thus giving a product with a softness only desirable for machining. Silicon is a softener by reason of its influence on carbon, and it also lessens shrinkage for the same reason.

The 10 to 18% grade of ferrosilicon when added to ladles of iron does not dissolve with sufficient ease to produce much effect on the metal. Preheating of such an alloy before adding makes for better results, but the

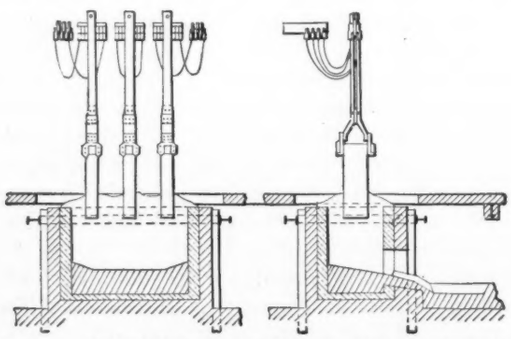


FIG. 3. ELEVATIONS OF THREE-PHASE SERIES FERROALLOY FURNACE

cost of such a procedure is well-nigh prohibitive. In recent years, Outerbridge has tried out 98% silicon alloys, but this proved unsatisfactory because of the high melting point and low specific gravity of the metal. A 50% ferrosilicon alloy has demonstrated its effectiveness in the foundry. Its greatest practical value lies in the fact that cheaper grades of pig iron may be charged into the furnace, and also it gives absolute control of the iron produced.

According to Thomas Baker, the effect of silicon on the mechanical properties of iron may be summarized as follows: Although the addition of silicon to iron increases its elastic limit and tenacity, such an increase is obtained at the expense of a loss in ductility. The loss in ductility, in material that has been well annealed, is quite small until the silicon reaches 3%; above this the ductility loss increases rapidly, and at 4% the ductility is almost nil. With increasing percentages of silicon the alloys increase in hardness. As already mentioned, several other alloys containing silicon have been produced for foundry purposes. These include ferrosilicon-aluminum, ferrosilicon-manganese-aluminum, ferro-silico-manganese, silico-calcium-aluminum, etc. These are employed for the purpose of rapid deoxidation and purification, as they form easily fusible silicate slags.

Copper Mountain Mine, British Columbia

The Canada Copper Corporation, besides its British Columbia Copper Co. operations at Greenwood, B. C., has been developing another copper property, known as the Copper Mountain. The company spent $396,000 in 1916 on the development of this property and on the purchase price of certain neighboring claims, under bond. The annual report just issued gives some details of the work done last year to confirm the previous diamond drilling. This was mainly in the nature of underground development, which may also be utilized for the permanent operation of this property. To expedite the underground work, a power transmission line 13.6 miles in length was brought to Copper Mountain from Princeton, B. C., where a lease of a power plant had been secured. On the Copper Mountain property, a tunnel, 9 x 9 ft. in the clear, was driven a length of 2100 ft. on the 3950 level, and numerous lateral drifts and raises were made, the total amount of this work being 5206 ft. As soon as it became apparent that the results secured from diamond drilling were reliable, drilling from the surface was resumed, and 8007 ft. of diamond drilling was done in 1916. In addition 2364 ft. of surface trenches were opened on newly located claims. No material increase in ore reserves is reported for the period under review, because the underground work was done especially to check the accuracy of the previous diamond-drilling operations. Underground diamond drilling is now being done from faces opened last year, and new ore is reported encountered.

Prior to the execution of the underground-development campaign, it was deemed expedient to class the ore as "reasonably assured" and "probable." It is now estimated that there were 10,000,000 tons of definitely assured ore and 2,000,000 tons of probable ore. The average grade of this tonnage is 1.74% copper and 20c. per ton of recoverable gold and silver. The ore thus far developed is well above the river level. The ore is of primary nature and while likely to extend below the level of the river, operations for many years to come will be confined to areas above the river, and extraction will be by means of tunnels. Approximately one-half of the ore thus far developed will be extracted by means of opencut mining.

At the beginning of 1916 a 50-ton experimental flotation mill was placed in operation for the purpose of outlining definitely the metallurgic procedure to be adopted in a large mill. The opinion of the company's own staff regarding the geologic features is said to have been confirmed by an independent report on the properties by Sydney H. Ball. Allen Hastings Rogers, who also made an independent report on the property, confirms the company's estimates of tonnage and value. His conclusion was that the property is sufficiently developed to warrant the erection of a mill having a capacity of 3000 tons per day. The cost of producing copper was estimated at 9.57c. per lb., based on existing smelting rates.

Chrome-Vanadium Steel Gears used in the transmissions of automobiles have the following specified composition, according to "American Vanadium Facts": Carbon, 0.38-0.43%; chromium, 0.82-1.05%; manganese, 0.70-0.90%; vanadium, minimum 0.12%.

Manitoba As a Mining Province

By J. A. Campbell*

SYNOPSIS—Recent developments in the Flin Flon and Herb Lakes districts. Tug installed on Lake Athapapuskow and a new stern wheeler being constructed at The Pas. Notes on properties now being operated. Future of district promising. Need of prospectors to thoroughly explore mineralized area.

The name of Manitoba has so long been associated with No. 1 hard wheat that it would seem a contradiction in terms to connect it with any other line of production, especially so with something so fundamentally different from its well-known staple product as the production of minerals. Northern Manitoba appears destined to occupy a similar place in the production of minerals to that which the southern part of the province now holds in the raising of wheat.

Northern Manitoba unquestionably has mining resources that only await development. The known mining area is in the region of a chain or series of lakes and rivers stretching easterly from Lakes Athapapuskow, Schist and Flin Flon, near Manitoba's western boundary, to Herb or Wekusko Lake, a distance of approximately 90 miles. The former is reached from The Pas via the Saskatchewan River through Cumberland and Sturgeon Lakes, and the latter is 11 miles from the Hudson Bay Ry. at about Mile 82. In the former district have been discovered deposits of copper and in the latter veins of gold-bearing quartz, which have produced remarkable assays and are now beginning to yield good returns.

As is quite natural, the discoveries were first made and development work is now taking place at each end of the mineral area, the portions of the district that are the most easily reached by water and rail.

Anticipating to some extent the development of the district, the Provincial government through the Commissioner of Northern Manitoba, let a contract early in the fall of 1916 for cutting out and clearing a roadway across the portage between Sturgeon Lake and Lake Athapapuskow, a distance of about 17 miles; and while the road has not been completed, sufficient work was done in the fall to allow it to be used as a winter road. The advantage of such a road is apparent, and it is the intention to complete the work and put the road in reasonably good shape for summer hauling as soon as possible.

During the winter the Mandy Mining Co., a subsidiary of the Tonopah Mining Co., of Nevada, took in considerable machinery and a full line of supplies for the summer work, for they purpose going ahead with mining operations and the transportation of the ore to as great an extent as is possible during the summer months. Last winter a 52-ft. tug was purchased and transported overland to Lake Athapapuskow. This was a notable piece of freighting—14 tons a distance of 65 miles. A stern-wheeler and four barges are now being built at Schist Lake for work on that body of water. The Ross Navigation Co. also has another stern-wheeler under construction at The Pas, in addition to several barges.

There were taken into the mine last winter a hoisting engine, a 150-hp. boiler and a compressor with all necessary equipment for underground mining, also full equipment for a sawmill, which has been set up and is now running. A gas tractor of the caterpillar type, capable of hauling 20 tons, is now on the ground and will be tried out over the portages.

THIRTY-SIX HUNDRED TONS OF ORE AT STURGEON LANDING, HAULED 40 MILES FROM MANDY MINE, SCHIST LAKE, MAN.

At the other end of the series or chain of lakes and rivers is Herb, or Wekusko Lake, where somewhat different conditions are found. The showings here are all in the nature of gold quartz, with traces of other metals. Within the last few months a camp has sprung up here, and several groups of claims are now being actively developed. J. Burr Tyrrell, well known in connection with northern exploration, outlined the geology of this lake district some time ago and reported favorably on the formations as a probable field for auriferous quartz. His report was read by M. J. Hackett, an experienced prospector and miner, who was sufficiently influenced thereby to

*Commissioner of Northern Manitoba, The Pas, Man.

make a prospecting trip into the district in question and in the summer of 1914, accompanied by R. Woosey, discovered gold-bearing quartz in what is known as No. 1 vein of the Kiski claim. Before returning from the field Hackett and Woosey stripped and trenched this lode sufficiently to satisfy themselves that their discovery was valuable. They returned to The Pas and exhibited specimens which resulted in other prospectors going into the field and staking claims.

Since that time considerable prospecting has been done, but it has been confined for the most part to a strip of territory five miles long by two miles wide, beginning at the Kiski claim at the south and ending with what is known as the McCafferty claims on the north. Various veins have been discovered within this area, and several groups of claims have been disposed of to outside capitalists. During last fall and winter a great deal was done in the way of developing some of the most promising of the claims, culminating in the introduction of mining machinery and the shipment of a car of ore to Trail smeltery.

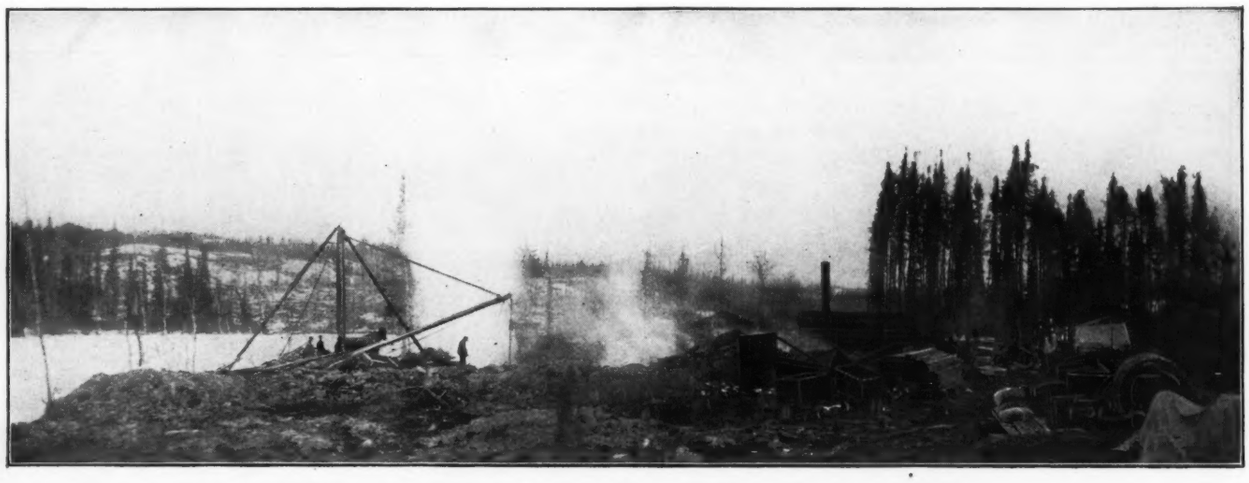
The original discoverers of the Kiski-Wekusko claims disposed of their interest to a Toronto syndicate. Since the change in ownership a few months ago a contract was let for sinking a shaft, which is now down 30 ft. The average width of the vein is about 3 ft. 6 in.; the gangue is well mineralized with arsenopyrite and chalcopyrite, and free gold is often visible to the naked eye; a full equipment of machinery for this property has been purchased, but shipment will be delayed until the wagon road from the Hudson Bay Ry. to Herb Lake has been completed. In the meantime prospecting will be carried on by means of stripping, trenching and a thorough sampling of the property.

Probably the best-known group at the lake is the Rex, consisting of seven adjoining claims. Most of these were located by Campbell, Hassett and Moore. Claims owned by others were added to the group, which was sold last fall to Makeever Brothers, of New York. Their engineer spent considerable time starting operations on the property, and before the end of the year, camps had been erected, a steam plant consisting of drills, hoists, pump, etc., had been installed and the men employed placed in charge of a capable overseer. A recent report is to the effect that shaft No. 1 is now to a depth of 80 ft., that the values at this depth are high and that the vein is increasing in width. Work has begun on No. 2 shaft.

The Northern Manitoba Mining and Development Co. recently shipped a carload of 57,000 lb. of gold-bearing quartz to Trail, British Columbia. The returns for the car were $2323 in gold, and average of $81.53 per ton. The company is purely a local concern, the organizers being well-known engineers and mining men. It is the only company that has as yet put shares on the market for general sale.

The work already done on this property consists of a shaft sunk to a 50-ft. level. There is installed at the mine a 50-hp. boiler, a 5-drill air compresser, drills, hoists, pumps and other equipment. At the 100-ft. level, drifts will be started both north and south. Channel samples at the bottom of the shaft have given assays of $170 per ton, and the vein has increased in width from 15 in. to 2 feet.

After disposing of their holdings in the Kiski and Rex properties respectively, Hackett and Campbell consolidated their interests in certain other claims with those of J. M. Wanless, resulting in the Elizabeth-Dauphin group of four claims. These were sold and a company, "The Pas Consolidated Mines," is now being organized to develop and operate them. The property shows an exceedingly well-defined vein of great promise.



MANDY MINE, SCHIST LAKE, 90 MILES FROM THE PAS, MANITOBA

In addition to what has already been mentioned, work of importance has been done on various individual claims. The McCafferty lode, to the extreme north of the staked area, has produced some very rich surface specimens and the vein has been stripped for over 1200 ft. There have been some good showings also from the Nemo, Trapper, Center Star, Bingo, LeRoi and Ballard.

The fissure in this mineralized zone cuts several formations; namely, chlorite, schists, gabbro, quartz, porphyries and altered gneiss. The values do not seem to be confined to any particular formation.

The great need of this camp is a wagon road to connect with the Hudson Bay Ry. Early this year J. P. Gordon, formerly assistant chief engineer of the Hudson Bay Ry., who is thoroughly acquainted with the country, made a reconnaissance and survey and marked out a road from mile 82 to the lake, about 11 miles in length, which can be built at a minimum of expense. The Provincial government has since called for tenders,

and it is expected that the contract will be let and the work begun in a very short time. The construction of this road will enable those interested to take in machinery, supplies and equipment throughout the summer, and the work of mining development can continue without interruption.

The whole mining district north of The Pas is and has been for some considerable time attracting attention among mining men both in the United States and Canada. Further discoveries have been made and claims staked in other parts of the previously mentioned mineral areas, between Athapapuskow and Herb Lake, but no development work has yet been done thereon. Discoveries have been made from time to time at Island Lake, Piquitona, Kettle Rapids, Cross Lake and other places. Just what these will amount to remains to be seen. The need of the country, however, is prospectors. Compared with other mineral districts that have been exploited, the discoveries already made have been marvelous when it is considered how few people have been engaged in real prospecting work.

Greene Cananea Copper Co.

The Greene Cananea Copper Co. is the owner of all the shares of the San Pedro Copper Co., a Mexican Corporation and of 961,869 shares out of an outstanding issue of 1,000,000 shares of the capital stock of the Greene Consolidated Copper Co., a West Virginia corporation, which company in turn owns all of the shares of the Cananea Consolidated Copper Co., a Mexican corporation.

The combined net income of the Greene Consolidated Copper Co. and the San Pedro Copper Co., for the year 1916 amounted to $7,673,184.39. The net income for the year, derived from dividends of subsidiary companies and interest on deposits amounted to $3,435,879.26. Four dividends, one of $1 and three of $2 each, aggregating $3,418,946.90 were declared during the year. The total producing and marketing cost of refined copper, excluding cost of custom ores, was 11.352c. per lb. The average price received for copper produced during the year was 25.541c. per lb. The total production from the mines and works owned or controlled by the company was:

	Copper, Lb.	Silver, Oz.	Gold, Oz.
The Cananea Cons. Copper Co	48,663,381	1,503,826	9,253
San Pedro Copper Co	4,707,430	154,454	1,296
Custom	8,879,256	317,454	1,143
Total	62,250,067	1,975,734	11,692

The Cananea Consolidated Copper Co. S. A. produced during the year 48,663,381 lb. of refined copper at a cost, including all expenditures, of 11.395c. per lb. The price received for this production, all of which is sold, was 25.430c. per lb. Operating profits for the year amounted to $6,908,513.45, after charging off all expenses, depreciation, etc. Dividends amounting to $3,500,000 were distributed to the stockholders during the year. Operations for the first time since 1912 were continued for a full year without serious interruption. The cost of production was, however, higher than for previous years of full operation, and will be even higher for the current year, principally on account of the taxes the operating company is compelled to pay and the increasing high cost of labor and supplies.

The Cananea Consolidated Copper Co. produced and treated during the year, 1,143,508 tons of ore, smelted 1,141,819 tons of domestic and 85,203 tons of foreign ore, and 11,129 tons of customs ore and matte; 352,843 tons of domestic ore and 28,765 tons of foreign ore was milled, the ratio of concentration being 2.922:1. The company ores produced 48,663,381 lb. Cu., 1,464,808 oz. Ag and 8710 oz. Au, the custom ores and matte producing 8,879,256 lb. Cu, 317,454 oz. Ag and 1143 oz. Au.

The mill treated 362,116 tons of ore at a cost of $0.83617 per ton, the smeltery treating a total of 906,512 tons of "new material" at a cost of $2.3951 per ton. During the year more than $1,000,000 was paid in taxes, from which the company had been previously exempt.

The San Pedro Copper Co., S. A., produced during the year 4,707,430 lb. of refined copper at a cost of 11.082c. per lb. Mining was continuous throughout the year at the Sierra de Cobre mines, in which this company has a 40% interest. Operations at the Cananea-Duluth mine were resumed in May, the first deliveries of ore being made in June. During the year new ore bins were completed at the collar of the Cananea-Duluth shaft and railroad extensions were made, making it possible to eliminate considerable difficulty and expense in surface handling of this ore. In 1917 it is planned to sink the Cananea-Duluth shaft below the 600 level. Owing to the great increase in the rate of taxation it was decided after a thorough examination by geologists to drop certain of the claims, thus reducing the company's holdings to 536 pertenencias, equivalent to 1324 acres. Dividends amounting to $100,000 were paid during the year.

Rushing for the Cage

A bad and dangerous practice among men working in the mines is rushing for the cage at quitting time, says James Dineen in the *Spelter Journal.* Pushing and shoving one another, each trying to get ahead of his fellow-workman, is usually done in spirit of amusement and without realizing the danger it incurs.

I saw in one of the Butte mines some time ago an accident which plainly shows how the lives of men are endangered by this foolish practice. The cage was lowered to the station, and in this case the lower deck was to be loaded first. Two bells was the signal to lower the cage in order to load the upper deck. The station tender was having considerable trouble to get the men to line up and to take their turn, but they refused to listen to him. As soon as the cage stopped, they all made a rush to get on, and in the melee someone caught the bell rope and must have rung two bells, for the engineer began to lower the cage. Of course the gates were open. Some of the men were in the act of stepping on the cage and had one foot on the cage and the other on the station. As the cage was lowered the gates caught on the bottom of the station, causing them to bend double. One gate caught a man over the head and had it not been for the presence of mind of the station tender would have severed it from his body. Naturally the men who were in the act of getting on the cage were pushed by those behind, causing them to fall against the cage and over the heads of those who were already on it. Now, supposing that the signal had been given to hoist, as could have been the case, those men would have fallen headlong into the shaft.

Analyzing Limestone and Ammonium Salts*

SYNOPSIS—A description of the use in analysis of two indicators, thymolphthalein and naphtholphthalein, that have advantages over the chemicals heretofore employed. The character and use of the indicators are outlined.

Some new applications of the indicators, thymolphthalein and naphtholphthalein, have been developed in analysis of various substances, among which may be mentioned first a rapid method for analyzing limestone by titration.

The indicator thymolphthalein is one which, although little known to the generality of chemists, possesses certain qualities that distinguish it from almost all other indicators and render it capable of being used to solve problems in analytical chemistry that cannot be solved by the use of the common indicators. The particular property I refer to is that of being insensitive to minute traces of alkali, particularly at the boiling point; and the application of this property to the analysis of limestone depends on the fact that when magnesium hydrate is coagulated (presumably dehydrated) by boiling, it becomes so insoluble that, strong base as it is, it is then incapable of affecting this indicator, although it still colors phenolphthalein. In consequence of this property it is possible to determine CaO and MgO in a limestone by titration in about 30 min. The following is the process: The requisites are (1) $2N$ hydrochloric acid,[1] made by diluting concentrated HCl five times and carefully standardizing 20 c.c. against pure crystalline $KHCO_3$ with methyl orange—the third place of decimals in the factor of this acid must be accurately ascertained, (2) accurate $N/2$ NaOH made from material free from carbonate and with boiled distilled water; this to be standardized with phenolphthalein, (3) a small quantity of $N/2$ HCl, (4) 1% solution of thymolphthalein in 60% or 70% alcohol, (5) 0.02% solution of methyl red in dilute alcohol.

Analysis of Limestone

The carefully sampled and mixed limestone is brought to 60-mesh, and from ½ gram to ¾ gram is thoroughly agated in two or three portions until the powder is perfectly gritless, weighed (to three places only) and transferred to a high, narrow beaker with cover glass. A narrow 10 c.c. burette is filled with the $2N$ acid, and from 0.5 to 10 c.c. of the acid is run in at once and immediately mixed with the powder so that no dry portion remains. After half a minute the adhering drop of acid near the top of the beaker is washed down with 1 or 2 c.c. of water and the beaker placed on the steam bath for 20 min. (if $MgCO_3$ is small in amount, 5 min. will suffice); meanwhile two other burettes (common ones will do) are filled to the zero with $N/2$ soda and $N/2$ HCl respectively. The narrow burette from which the $2N$ HCl has been run is then read, several minutes having elapsed so that it shall have run down properly, as it is necessary to read the quantity used accurately to two places of decimals. The turbid solution of the limestone is then diluted to about 20 c.c., treated with some methyl orange, and the $N/2$ NaOH run in until the red methyl orange has turned yellowish salmon. If ½-gram sample has been taken and 9.5 c.c. acid, then 18 c.c. NaOH can be run in at once and the rest slowly; then methyl-red solution is added to a strong pink color and the titration finished drop by drop to pure yellow. The methyl orange is used merely as a warning of the approach of the end point, and a skilled operator may omit it; nevertheless time is saved if the operator has the warning given by methyl orange.

The amount of $2N$ HCl multiplied by 4 (and the HCl factor) is the true $N/2$ HCl originally used to dissolve the sample, and this, less the $N/2$ NaOH required to the methyl-red end point, gives the acid equivalent of the CaO and MgO together.

Estimating the Magnesium

To determine the MgO, the neutralized liquid is diluted to at least 50 c.c. and boiled for a minute. Longer boiling to displace the CO_2 is unnecessary, as the bulk has disappeared in the first effervescence with undiluted acid. Thereon about 3 c.c. of thymolphthalein solution is added, followed by a known quantity of the $N/2$ NaOH sufficient to give a dark inky blue, and the mixture is boiled for a minute to coagulate the precipitated magnesia. Since 1 c.c. of NaOH corresponds to 2% MgO on a ½-gram sample, it is important not to add a great excess of NaOH at this stage, but a very dolomitic sample may require 10 or 15 c.c. before a blue is obtained that will stand boiling. The blue suspension having been obtained, the mixture is vigorously stirred while titrating back to yellow (through green) with $N/2$ HCl, when just at the end point, a transient red spot (due to acid methyl red) will appear in the pale-green mixture. It is important not to overshoot this end point, since owing to the presence of MgO, the mixture remains yellowish, although overdone.

The known NaOH added to give the blue, less the HCl required to restore yellow, is a measure of the precipitated magnesia; therefore each c.c. × 0.0101 = weight of MgO. The factor is MgO/4, because Mg is bivalent and $N/2$ NaOH has been used.

Finally, to get the CaO, subtract the cubic centimeter of NaOH used in the magnesia calculation from the cubic centimeter as the acid equivalent, the difference being the acid equivalent of the CaO alone, and this in c.c. × 0.01403 = weight of CaO present.

It should be noted that the second addition of NaOH liberates $Ca(OH)_2$ as well as MgO, but as $Ca(OH)_2$ is soluble at the dilution used, it affects thymolphthalein just as much as NaOH does and therefore does not use up NaOH. Nevertheless, being very sensitive to CO_2, it must not be exposed to it, for example, by unnecessarily long boiling over a bunsen or by allowing oneself to be interrupted at this stage of the process.

The theoretical CO_2 in the sample can also be calculated by multiplying the acid equivalent in c.c. by 0.011, and in most cases agrees within 1% with the loss on ignition of the sample, the latter being nearly always larger owing to moisture and organic matter, if present.

*An article by Dr. James Moir, published in the "Journal" of the Chemical, Metallurgical and Mining Society of South Africa, February, 1917.

[1]Weaker acid would fail to dissolve $MgCO_3$ if present; 2 N acid is not volatile on the steam bath, only giving off steam, not acid.

Finally, the "silica insoluble" of the sample can be obtained by adding to the final product of the titration a little $N/2$ HCl—just enough to dissolve the Mg, Fe and Al in the precipitate and to cause a red color which resists boiling, and after a couple of minutes' boiling, filtering off, washing and igniting; even gelatinous silica is coagulated by the numerous boilings done close to the true neutral point.

Alumina in Limestone

A rough estimate of the alumina in a limestone which does not contain much iron can also be obtained from the difference between the methyl-orange and methyl-red end points at the begining. The Al is in solution as AlOCl at the former end point and precipitated at the latter; therefore the difference of the titrations (with $N/2$ NaOH $= N/2$ AlOCl $= M/4$ Al_2O_3 as the basis of calculation) gives the amount of alumina; this is however, only rough, since the methyl-orange end point cannot be accurately ascertained.

Since the calculations are complex, it is desirable to eliminate all acid and alkali factors; time spent on accurately adjusting the three solutions to the factor 1.000 will repay itself afterward, providing for easy and rapid estimations in the regular routine work.[2]

It will be as well if I give an example of the calculation in the case where the factor is not 1.0: Suppose 0.681 grams of agated limestone has been treated with 9.72 c.c. of the strong HC (say $2N \times 1.007$) and that 14.2 c.c. $N/2$ NaOH of factor 0.993 were required to reach the methyl-red end point. The original true $N/2$ acid used is $9.72 \times 1.007 \times 4$, or 39.15 c.c., and this less 14.1 c.c. (the NaOH corrected for its factor) or 25.05 c.c. is the acid equivalent of the CaO + MgO in the sample. Suppose, then, that after the thymolphthalein 2.0 c.c. NaOH were added to get a permanent blue and thereafter 0.65 c.c. HCl used to remove the blue color, the difference due to magnesia is 1.35 c.c. The percentage of magnesia is

$$1.35 \times 0.0101 \times 100 \div 0.681 = 2.00\%$$

In this case the NaOH factor is so close to 1.0 that is may be ignored. Next subtract 1.35 from 25.05, and the difference is the acid equivalent of the CaO alone, namely, 23.70, and the percentage of CaO is

$$23.70 \times 0.01403 \times 100 \div 0.681, \text{ or } 48.9\%$$

Again the calculated (or theoretical) CO_2 is

$$25.05 \times 0.011 \times 100 \div 0.681, \text{ or } 40.5\%.$$

In this case we thus account for 91.4% of the sample, the balance being silica, alumina, iron oxide, water, organic matter, phosphoric and sulphuric anhydrides and alkalies, many of which are usually absent; but it should be noted that when SO_3 is present, the CaO found is low by a corresponding amount and should be corrected if the SO_3 is worth counting. My process only determines lime and magnesia present as carbonates, oxides, or silicates; that is, in so far as combined with weak acids. As regards P_2O_5, if it is found to be present in appreciable amounts, the CaO found by titration should be increased by $0.4 \times P_2O_5$ since in titration $Ca_3(PO_4)_2$ goes to $Ca(H_2PO_4)_2$.

Some results are appended of analyses done on the same sample by the new method and by the ordinary one.

[2]This factor is sensitive to charges of temperature; if it is 1.000 at 25° C., it is 0.998 at 29° C., and 1.002 at 21° C.

NEW METHOD

	Sample A	Sample B	Sample C	Sample D
Found CaO	45.6	27.1	36.1	47.5
Found MgO	3.2	12.5	6.5	6.9
Calc. CO_2	39.4	34.9	35.4	44.1

ROUTINE METHOD

	Sample A	Sample B	Sample C	Sample D
Found CaO	45.8	26.9	36.2	47.0
Found MgO	2.9	12.2	6.4	7.1
Loss in ignition	39.75	34.8	36.0	43.5

Determining ammonium salts by titration gives another example of the use of the peculiar indicator thymolphthalein. The object of the new process is to determine ammonia in its neutral salts as occurring in explosives, fertilizers, etc., without the trouble of distillation. Thus explosives may contain $KNO_3 + AmNO_3$, the sum of which is obtained by water extraction after removing nitroglycerin and similar substances by ether, whereon the $AmNO_3$ may be determined by the new process, giving the other salts by difference.

The process depends on the fact that ammonia is a weak base and is unable to affect certain indicators like thymolphthalein[3] unless it is present in large quantity. The "avidity" of NH_4OH is about one fifty-fourth of that of NaOH, so $N/10$ ammonia only affects indicators as $N/540$ NaOH would do. The solution is heated to boiling, having been previously made neutral, if necessary (methyl red is the best indicator for this) and titrated with sodium hydrate ($N/5$ is best) in presence of thymolphthalein (small quantity of saturated solution in 50% alcohol). A pale-blue color appears as the end point is approached, and the solution is again boiled till colorless and more NaOH added until the blue color is deep and withstands boiling for 20 seconds; it is not necessary to boil off all the ammonia as would be the case were the common indicators used. A correction of 0.20 c.c. is subtracted, and the corrected amount of NaOH used then corresponds to $N/5$ NH_3 in the original solution of the salts. The first appearance of the pale blue occurs when about 90% of the NaOH has been added. It should be noted that if methyl red has been added, the colorations are green instead of blue. The solution to be titrated should contain about 1% ammonium salts.

The following are results obtained by the method:

(1) *Am_2SO_4.* 10 cc. $N/10$ Am_2SO_4 required 5.15 cc. = 4.95 corrected = 99% of theory.
15 cc. required 7.70 cc. = 7.50 cc. corrected = 100% of theory.
40 cc. required 20.12 cc. = 19.92 cc. corrected = 99.6% of theory.
(2) *Am Cl* (dried) 0.1640 in 20 cc. water required 15.55 cc. = 15.35 cc. corrected = 100.1% of theory.
(3) $AmNO_3$ (dried) 0.1450 in 20 cc. water required 9.28 cc. = 9.08 cc. corrected = 100.2% of theory.
(4) $Am_2C_2O_4.H_2O$ 0.2470 used 17.55 cc. corrected = 101% of theory (possibly the specimen had effloresced).
(5) $AmClO_4$ commercial containing 2.0% $NaClO_4$, 0.435 used 18.10 cc. = 97.8% true $AmClO_4$.
(6) Am_2HPO_4 (methyl red cannot be used) 0.1685 used 13.15 cc. NaOH = 102.9% of theory.

It will be seen that the method does not work very well with ammonium salts of weak acids.

The determination of true neutrality in waters by means of mixed indicators is well known, particularly the use of methyl orange mixed with phenolphthalein, which is yellow near neutrality and pink if either acid or alkaline. This mixture is, however, quite insensitive and will not detect less than 2 parts per 100,000 H_2SO_4, or $Ca(OH)_2$; that is, it remains yellow or salmon colored over the whole of this range of acidity or alkalinity; also the fact that a salmon color may mean either slight acidity or slight alkalinity is a fatal drawback. My improvement consists in using indicators

[3]The only other indicator of this class that is easily obtainable is alzarin yellow R, which changes from yellow to pink.

that are 10 or 20 times as sensitive, and the particular mixture I recommend is one of methyl red (orthocarboxylic acid of "butter-yellow") with *a*-naptholphthalein, which in addition are chosen so that the alkaline color of the one should be as different as possible from the acid color of the other. This mixture added to a water will detect 0.1 part H_2SO_4 and 0.2 part $Ca(OH)_2$ per 100,000. The acid color is violet-rose (with any amount of acid greater than 0.4 per 100,000); the color in presence of 0.2 parts acid is salmon-orange; the neutral color is straw-yellow; the color in presence of 0.2 parts alkali is citrine-green, and the full alkaline color (over 0.4 parts alkali) is deep bluish green; the whole of these five changes occurring very near to the neutral point from $+\frac{1}{2}$ to $-\frac{1}{2}$ part per 100,000. There are also several intermediate tints, so that each part per million has its shade. By adding some phenolphthalein to this mixture a triple indicator is obtained which goes through all the seven colors of the spectrum in the correct order as it passes from alkalinity to acidity; that is, purple, indigo, green, citrine, yellow, salmon and rose.

a-Naphtholphthalein is made by heating *a*-napthol with phthalic acid and excess of dry $ZnCl_2$ to 120° C. for two hours. *a*-Naphthol can be purchased, and phthalic acid made by boiling naphthalene with dilute HNO_3 (under reflux) for several days and taking the liquid to a small bulk. Since methyl red (or the materials to make it) may not be available for some time, I also describe the colors given by mixtures in which substitutes for it are used (the other constituent being *a*-naptholphthalein, for which there is no substitute): A. Neutral-red; range of mixture; violet-pink, salmon-pink, neutral tint (dirty brown), light green, and blue-green. The neutral tint at the neutral point is interesting. B. Rosolic acid (or alizarine); range of mixture; dull yellow, salmon, rose, violet, indigo-blue (rose being neutral).

The Duty of Inspection

By Chesla C. Sherlock

The duty of mine owners and operators to inspect machinery to be used in mining ore or in other hazardous ways is a matter of great interest. In the absence of express statutes on the subject this duly exists, and what it includes is a question that is being continually brought to the attention of the courts.

In a New Jersey case it was held that the duty of a master to his servant to exercise reasonable care is performed when he provides an apparatus in common use, purchased from a reputable and experienced manufacturer, and makes a test, where a test is required by law.

The New York court, speaking in a similar case, said: "While the employer must exercise reasonable care to furnish safe implements, he is not liable for the negligence of others not his servants, nor is he negligent in relying upon the performance of duty by reputable contractors." In another case the same court said: "When an employer purchases an engine or machine of a reputable manufacturer, fully equipped with all the usual guards and appliances in customary use by men in the same business, he has a right to use this machine in the condition in which such machine is furnished to him, in connection with his business, without any imputation of negligence because it might have been made safer if made and equipped in some other way."

In a Massachusetts case it was held that the owner of a quarry owes no duty to his employees to inspect exploders given to the quarrymen for use, where the manufacturers were well known and had made frequent tests of the exploders.

The rule, however, is different where the appliance or machine is purchased second-hand. In that case the master has no right to rely upon the statement of the seller or upon the name of the manufacturer. The duty to personally inspect, either himself or through his agents, is imposed upon him. And the Illinois court has held that the duty to inspect old, rusty and worn parts placed in machinery is more urgent and necessary. The same opinion is entertained by the Missouri court when an ordinary appliance is to be put to an extraordinary or hazardous use, notwithstanding it may have been purchased from a responsible source. The several opinions on this point seem to agree and fairly well establish the correct rule of action.

Where machinery has been purchased from a reputable manufacturer, all that the employer is bound to do is to test it to see if it is in good running order. Beyond that, no duty is imposed upon him, unless other defects were obvious such as would cause an ordinary prudent man to investigate.

The courts do not hold an employer responsible for a lack of technical knowledge which is ordinarily possessed only by persons in certain lines of business and which it would therefore be unjust to expect other persons to possess.

The Federal courts, however, have not taken the liberal view of the proposition expressed above. They have held that the rule that the purchaser of an article from a reputable manufacturer is justified in assuming, in the absence of anything to the contrary discoverable by ordinary tests, that the article is properly made, is not absolute in the sense that it absolves from all duty of reasonable inspection, nor in any case does it relieve from inspection as to defects discernible by superficial examination.

Thus, the presumption that a tool is safe for use when purchased from a reputable manufacturer cannot be indulged when the tool in question was not one ordinarily in use, but was of a special design of the defendant, and the manufacturer had no knowledge that it was to be used in the manner described.

In some states statutes have recently been passed defining more definitely the rights and liabilities of employers to plead the exemption noted. In other states, the right has been taken away entirely by express legislation. The question, specifically as it applies to each employer, is a matter of local law, but the correct general rule is announced above.

Slag Paving Bricks may be made from almost any class of iron blast furnace slag for about $6 per thousand, although salable for as much as $35 per thousand. It has been estimated that after using two million tons of slag annually for cement manufacture there will remain 16 million tons available for making paving bricks, an amount capable of producing two billion blocks, and sufficient for 1000 miles of 50-ft. road.

In presenting these facts at the recent annual meeting of the American Ceramic Society in New York, J. B. Shaw mentioned that difficulties in manufacture had now been overcome and that precautions to be adopted arose from the necessity of treating the hot slag as it comes from the furnace, and heating the brick out of contact of air or steam to avoid brittleness.

Proposed Rejuvenation of Bendigo*

SYNOPSIS—Bendigo, Victoria, Australia, better known to mining men as the Bendigo Reefs, has, during the last few years, fallen off not only in its gold production, but in its mining operations to an extent that does not seem warranted by the prospective importance of the district. A plan is proposed whereby the district may be rejuvenated, which applies to other districts equally as well as to those cited.

Bendigo, 101 miles northwest of Melbourne, was one of the earliest Australian gold fields. Gold was discovered in 1851, and work was at first confined to alluvial deposits. Specimens of gold-bearing quartz were later discovered in outcrops of what are known as saddle reefs, and for 65 years a steady, although somewhat varying in quantity, gold yield has resulted.

The character of the deposits has been so frequently described in detail that it is only necessary to briefly refer to them and to the geological surroundings.

The district is composed almost entirely of sedimentary rocks contorted by lateral pressure into corrugations the axes of which run approximately 17° west of north. These beds are of the Ordovician age, and it is supposed the folding occurred at the end of the Devonian period.

During the process of folding, frequent cracks occurred across and between the beds of sandstones and slates that make up the formation, this fracturing occurring more particularly at the crests and in the troughs of the corrugations, forming "saddles" and inverted saddles which were subsequently filled with the gold-bearing quartz, for which the district has been famous.

The legs of these saddles vary in length, gradually dying out. No two reefs are alike, the illustration, Fig. 2, showing a cross-section through the Great Extended Hustlers shaft.

Although the area of the whole field is large, the main portion, within which most of the mines are situated, measured about 4 x 20 miles. Within this area is a portion called the Central Area, shown by Fig. 1, having a width of about one mile and a length of five miles, from which the major portion of the production of the field has been mined. This small section contains the middle group of mine reefs (of which there are no less than 29 on the whole field), a number of which have not been thoroughly prospected.

The illustration, Fig. 3, shows that many reefs never come to the surface and why systematic prospecting and development is needed to open deposits that should be as valuable as any yet worked.

Methods of Mining Followed

When alluvial deposits became exhausted, many small "reefing" claims were located along the quartz outcrops and a great number of shafts were sunk to shallow depths. As the quartz near the surface became worked out and mining became more difficult, the larger companies purchased the smaller or absorbed them. In this way the areas worked by each company became larger and assumed their present dimensions.

*Abstract of a report made by E. C. Dyason, mining engineer, Equitable Building, Melbourne, Australia.

As depth was gained, and with depth an increase in the water, engines were needed, and with the increasing investment, fewer shafts were worked. In recent years data compiled to show the relationship of reefs worked in one mine to those in another have accumulated. A mere collection of these data may not show when gold is to be found, but it will show that certain work is not worth doing, thus diverting capital to other work.

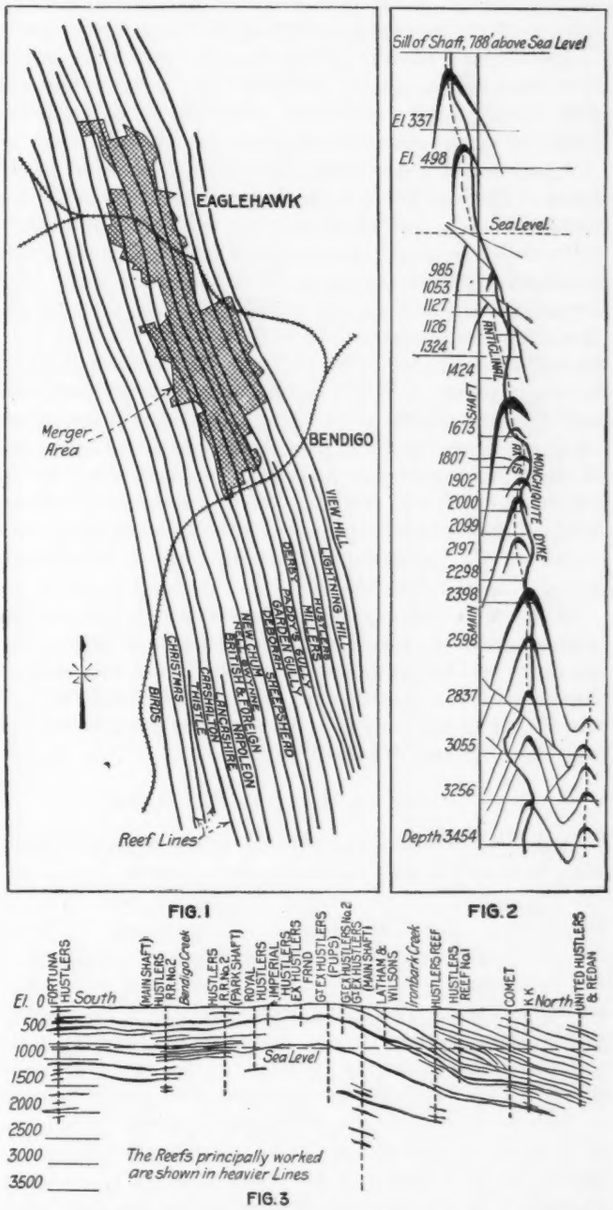


Fig. 1—Central area of Bendigo district. Fig. 2—Cross-section through Great Extended Hustler shaft. Fig. 3—Showing reefs that can only be discovered by underground prospecting

The records show a wide variation in cost per ton of ore produced by different companies operating under similar conditions, and it is apparent that large reductions in average costs can be made by the consolidation of the mines of the Central Area, consisting of over 40 properties operated by individual companies, each one of which has a board of directors, a legal manager and a

mine manager. Although the remuneration paid to the officers of the Bendigo companies is low and it is not on the grounds of expensive management that consolidation is proposed, duplications in plants, especially those that have reached great depths, might have been avoided, as the ground worked between two neighboring shafts could have been just as efficiently and economically worked from a single one of them, thus saving the expense, frequently many thousands of dollars, of sinking.

Many shafts which have shown no returns were also sunk in prospecting; other localities justify additional sinking, which, owing to lack of funds on the part of the owners of the property, cannot be accomplished.

From many of this latter class of properties, plants have been sold at a great financial loss, to be followed if work is ever to be resumed, by reëquipment with a heavy drain on reorganization funds.

As an example, the Derby line of reef, situated in the heart of the field between the best producing mines on the Garden Gulley and Hustlers lines of reef, and itself a main anticline, could be reasonably expected to be highly productive, yet the Johnsons Reef Co.'s No. 3 has been the only shaft sunk to any depth on it. In spite of the fact that this shaft had been deep enough to work it, an adjacent reef at 1200 ft. in depth lay undiscovered for many years. Ultimately this reef produced profitable ores, yielding 18,000 oz. of gold. In consequence, interest in the Derby line was greatly increased and a number of shafts were started, only to be abandoned after 300 to 400 ft. in depth was reached. Sixty to seventy-five thousand dollars could have been saved by the use of the Johnson's Reef Co.'s shaft, and this is only one of many similar cases in the district.

Artificial boundaries of the leases, which are usually most irregular in size, are often the cause of high costs, the same reef being frequently worked by two companies through two shafts, either of which could handle the entire output of both leases at but a slight increase in cost over that incurred by each one.

Economy in Development Work

Probably 20,000 to 30,000 ft. of development work must be done annually in the Bendigo district if the average production of gold during the last 50 years is to be maintained. Now the methods of mining out the reefs are not uneconomical, but the methods of prospecting and development to find them are exceedingly so. There are cases known where two men constituted the underground crew, doing effective work, while the directorate and management simply waited for the result of their efforts. This is partly due to custom and partly because of failure to realize the ordinary economic principles, but it is principally due to the fact that the Bendigo companies are too small and too weak, financially, to work properly. As an example, finances are so low that work underground has been restricted to one face, at a cost of, say, $300 per month. To keep going, top expense is $450 per month. During the month 35 ft. of driving is done, which will represent a cost of $21.45 per ft. Five faces being driven at the same cost per face as the one, and driven at the same speed, would lower the cost to about $11.15 per ft., a reduction of 54%.

What this points to is—that it would really pay a company to remain idle eight months in the year and work four months with a full staff and crew, rather than to work one or two faces continuously. Of course, labor covenants and the necessity of keeping the district alive would not permit this, but it would be preferable from an economic point of view. [The Australian Mining Act requires continuous labor on all property held by mineral lease, the number of men employed being in accordance with the acreage held.—Editor.]

The use of the diamond drill has never found favor in Bendigo for the reason that its advocates have claimed too much for it and its opponents admitted too little. The drill, if scientifically used, would be of great assistance in prospecting. It would not as a rule determine values, but by determining in advance where reefs did not exist, it would show where expensive crosscuts, drifts, raises and winzes could be avoided. The cost of drilling would be approximately one-sixth that of cross-cutting or drifting, and a drill could bore from crosscut to crosscut, saving much time, at one-fourth the cost of a raise.

Attempts to prospect by long crosscuts can only be condemned. It is not possible to prospect an anticlinal axis by merely crosscutting, and the expense of opening up a reef line from one of these crosscuts is very great.

Although many shafts on the main lines of reef have been unproductive, it does not follow that profitable ores do not exist there, as the prospecting may have been insufficient or misdirected.

The presence of water has frequently embarrassed the operations of a single company. If administration were centralized, adequate and economical pumping plants could be installed at the most convenient points instead of being scattered in small units, thus spreading the cost of keeping the mines dry over the entire field, at a much reduced total cost.

Proposed Future Policy

Ten years ago a million dollars was expended annually in development of the mines of the district. Today the expenditures are not over 25% of that amount. The change in the financial position of the district during 1914 and 1915 can be realized only when it is known that the gold production for 1914 was lower than for any previous year since 1891 and for 1915 the lowest in the history of the district.

Forty of the mines, which comprise those in the central area, should be consolidated and worked together. Not only do these companies lend themselves to most effective central administration, but the mines give the greatest facilities for carrying on operations in a big way, as they contain the reefs which so far have given the highest gold yield.

By the consolidation, the entire area could be operated as a single unit, all labor employed to be used at any point desirable so long as the quota of men was in proportion to the total area. Assuming that this was done and the average amount of development work in each property was done in four months in place of the full year, a saving of $100,000 would be accomplished, to say nothing of the probable gain due to increased efficiency of a constantly employed crew.

The arbitration court has recently increased wages by about 30%, making a total increase since 1912 of approximately 50%. The problem is, therefore, how to get the same results as in 1912 with two-thirds the number of miners. The one-man rock drill has been given a trial, and it has, in general, proven that, so far as the ore

broken is concerned, one man will obtain the same results as two men operating on a two-man drill, and in spite of the increased wages the breaking costs have been lowered.

Fuel economies, milling economies by operating one mill to capacity rather than two on half-time, centralization of pumping and hoisting as far as practicable with efficiency, centralized compressing plant and direction of operations by one general staff will all add their quota to general cost reduction, and there is no doubt that general expenses carried by each of the various companies could be so reduced as to make a considerable saving.

General purchasing and standardizing of equipment, reduction in necessary supplies and commodities; reduction in interest on loans or advances, would all add to increased profits, to say nothing of the greater possibility of reducing if not stamping out one of the large items of loss to the companies—that occasioned through gold stealing, which those with knowledge of the question estimate to be from $100,000 to $150,000 per annum.

For the amount paid for management of the companies of the central area, specialists could be secured, and these specialists, in continuous consultation, would form the controlling executive board.

Unless some method of securing more satisfactory results from the district is put into operation, mine after mine will be compelled to close down, and the economies necessary to secure these results can be obtained only by concentration of control, scientific management and coordinate mining, and these can be brought about only by an amalgamation of interests.

Supply of Platinum

The world's supply of metals of the platinum group is possibly 5,000,000 oz. says a bulletin of the U. S. Geological Survey. Estimates indicate that the crude placer platinum produced in the world since 1843 has been less than 4,632,000 troy oz., or about 159 short tons. Crude platinum is not pure, as it contains, besides iron, small amounts of one or all of the metals iridium, palladium, osmium, rhodium, and ruthenium.. The platinum in the world's stock of metals of the platinum group probably amounts to about 4,000,000 oz. It is estimated that there is about 1,000,000 oz. in the United States besides over 400,000 oz. of other metals of the group, principally palladium, iridium, and rhodium.

ESTIMATED WORLD'S PRODUCTION OF CRUDE PLATINUM, 1909-1916, IN TROY OUNCES

Country	1909	1910	1911	1912	1913	1914	1915	1916
Borneo and Sumatra	500	200	.....	.....	200	.....	.....	.....
Canada	30	30	30	30	50	30	100	60
Colombia	6,000	10,000	12,000	12,000	15,000	17,500	18,000	25,000
New So. Wales and Tasmania	440	332	470	778	1,500	1,248	303	222
Russia	264,000	275,000	300,000	300,000	250,000	241,200	124,000	63,900
United States	672	390	628	721	483	570	742	750
	271,642	285,952	313,128	313,529	267,233	260,548	143,145	89,932

It is known that the Colombian deposits whose output in 1916, shown in the table, was refined in the United States, will be more extensively developed during 1917 than ever before, and it is estimated that at least 30,000 oz. of crude platinum, containing 85% metal, will be derived from that source. It is hoped that in 1917 platinum derived from all sources other than foreign crude may exceed 7000 oz., and that the production of the crude metal will be at least 10% greater than in 1916.

The Russian situation is very difficult, but it is known that there are considerable stocks of crude platinum held in Russia which are available to the allied governments. It is believed that the production from Russia in 1917 will be considerably increased, perhaps equaling the 1915 output.

Normally the United States uses 165,000 oz. a year. part of which is obtained from scrap platinum. Dental manufacturers who formerly used between 25 and 30% of the supply are now using a number of alloys in place of platinum. The jewelry industry uses between 40 and 50%, practically all of which would be recoverable if needed. This industry has voluntarily agreed to limit the use of platinum in jewelry for the duration of the war.

Not much over 10 or 15% of the supply is used in American laboratories, all of which is recoverable. Government laboratories are apparently well supplied, and are not in the market at present. The United States mints refine platinum and doubtless have stocks sufficient for immediate governmental needs.

In 1915 about 44,000 oz., or 4% of the apparent United States stock of platinum, was used in contact-process sulphuric acid works. The acid made in these plants is very strong, and its use at this time is limited practically to munition makers. The production of sulphuric acid of grades in use in ordinary chemical industry does not depend on catalytic platinum, as such acid is made in lead chambers. The output of contact-process plants has increased nearly 200% since 1915, and it is understood that plants using this process are not yet operated to their full capacity. It therefore would not appear that there is any pressing need for a large supply of platinum by the sulphuric-acid industry.

From the foregoing statements the available supply of platinum in the United States appears to be adequate to meet immediate needs, but it should be emphasized that new demands may arise at any time which the present stocks of platinum in this country could not meet.

Substitute for Platinum in Crucibles

A gold-palladium alloy, under the name of "Palau," has been put on the market by a firm in California, according to *Commerce Reports,* Washington, May 2, and is offered as a substitute for the more expensive platinum-iridium alloy generally used by chemists. A crucible of this ware has been tested at the United States Bureau of Standards.

The loss in weight on heating to 1200° C. is intermediate between that suffered by crucibles of platinum containing 0.6 and 2.4% iridium, respectively. The melting point of the alloy is 1370° C., which corresponds to that of an alloy of 80% gold and 20% palladium. In resistance to most of the chemical reagents to the action of which such ware is ordinarily exposed, "Palau" compares favorably with ordinary platinum ware. The one noteworthy exception is fused alkali pyrosulphate, which attacks it much more than it does platinum. The ware is very promising as a substitute for platinum for many laboratory purposes.

Sand Filling of Stopes—Champion Copper Co.'s annual report for 1916 shows that 969,802 tons of ore and waste were hoisted during the period and 173,170 cu.yd. of sand returned to the stopes for filling.

The Philadelphia Flotation Decision

The majority opinion of the United States Court of Appeals for the Third Circuit, filed May 24, 1917, in the case of Minerals Separation, Ltd., vs. Miami Copper Co., appealed by both parties from the District Court of the United States for the District of Delaware, has attracted much attention in the mining world. The opinion, as expressed by Judge Woolley, is so exhaustive and expresses his viewpoint so clearly that it is worth the attention of the industry. Judge Woolley's decision follows:

These are appeals from a decree of the District Court in an action brought by Minerals Separation, Ltd., a corporation of Great Britain, against the Miami Copper Co., a corporation of Delaware, charging infringement of United States Letters Patent No. 835,120, issued to Sulman, Picard and Ballot, Nov. 6, 1906; No. 962,678, issued to Sulman, Greenway and Higgins, June 28, 1910; and No. 1,099,699, issued to H. Greenway, June 9, 1914, and owned by the plaintiff.

Of the claims in suit the court found claims 1 and 12 of the first patent valid and infringed and claim 9 invalid; claims 1, 2, 5 and 6 of the second patent valid and infringed; and claims 1 to 12 of the third patent invalid. The decree being in parts adverse to both parties, both appealed, presenting for review the same claims, excepting claim 9 of patent No. 835,120, with respect to which the appeal is abandoned.

As both parties are appellants, we shall speak of them as they stood in the court below.

Three Patents in Suit

The three patents in suit, to which we shall refer in the order of their issue as first, second and third, are for processes relating to water concentration of ores. They have for their object, stated generally, the separation of metalliferous matter from gangue or barren matter in ore pulp, by means of oils, fatty acids or other substances which have a preferential affinity for metal over gangue. The first patent, while employing the known selective affinity of oil for metal, is based upon a discovery that that affinity is greatest and metal recovery highest when the proportion of oil to ore is relatively least, and upon the disclosure that that property or characteristic may be brought into action and commercially utilized by agitating the ore-bearing pulp until a foam or froth arises to the surface, carrying with it and holding for recovery the extracted metal.

The process of the second patent is distinguished from the process of the first in that the frothing agent is soluble and develops in solution (when agitated to a froth) a selective affinity for metal similar to that of oil, the insoluble frothing agent of the first patent.

The characteristic of the process of the third patent is that concentration may be effected in the cold and without the aid of acid by the admixture of an aromatic hydroxy compound such as phenol or cresol in the place of the insoluble and soluble frothing agents of the other patents and by agitation of the pulp to a froth.

We are aware that this very brief statement of the distinguishing features of the three patents is technically inadequate and will be understood only by those familiar with the history and development of the art of ore concentration. As that art has been extensively considered and elaborately discussed by scientists and courts both in this country and abroad in cases in which the invention in suit was involved[1], we shall not make even a summary of the art or rehearse the history of this litigation as it has progressed in widely separated parts of the world, but shall rather adopt the whole litigious literature of the invention as matter preliminary to the consideration of the particular issues in this case, repeating only so much as may be necessary to throw light on this new chapter.

The First Patent

The invention of the first patent in suit is based upon a discovery of an wholly unexplained phenomenon arising from the agitation of ore pulp containing oil and air in certain proportions. This was a discovery in an art in which it was well known that the elements of oil, air and agitation possessed certain characteristics and produced certain results.

Haynes, in British Patent No. 488, of 1860, first suggested the use of oil in water concentration of ores by pointing out the affinity which oils have for metallic substances in preference to gangue. Carrie J. Everson showed, by Letters Patent No. 348,157, that a small quantity of acid in the pulp aids oil in distinguishing between metal and barren material with which it comes in contact. Elmore (Letters Patent No. 676,679), Kirby (Letters Patent No. 809,959), Froment (British Patent No. 12,778 of 1902), Cattermole (Letters Patent No. 763,260), Sulman and Picard (Letters Patent No. 793,808) and others employed the known affinity of oil for metal in ore concentration processes by using oil in proportions varying from 2% to 300% on the ore and recovering the oil-coated metal particles by causing them to rise to the top or sink to the bottom of the pulp.

Agitation of oil-impregnated pulp was old in the art. It was employed by Haynes, Everson, Cattermole, Froment, and Sulman and Picard. In these processes agitation was either gentle or thorough, but never great, and while always employed to produce a thorough oiling of the metal, it was used in different degrees for the sole purpose of causing the metal particles to rise or sink.

Air and other gases were also known and were developed in the form of bubbles to supplement the natural buoyancy of oil and to assist the oil-coated particles to the surface. This use of air was disclosed by Froment in 1902 and again by students of the University of California in the *California Journal of Technology,* in 1903, and by Sulman and Picard in the patent referred to (No. 793,808) commonly called the Bubbles patent.

Thus it may be stated generally that in the prior art, oil was used for its known selective affinity for metal, agitation to mix the oil with the metal and air to supplement the buoyancy of oil in raising oil-coated metal particles to the surface. To this extent had the art of oil

[1]British Ore Concentration Syndicate, Ltd., vs. Minerals Separation, Ltd., 25 R. P. C., 741, High Court of Justice, Chancery Division; affirmed after intermediate reversal in the Court of Appeals by the House of Lords in Minerals Separation, Ltd., vs. British Ore Concentration Syndicate, Ltd., 27 R. P., 33. Ore Concentration Co., Ltd., vs. Sulphide Corporation, Ltd., Supreme Court New South Wales, 31 R. P. C., 216, 217. Ore Concentration Co., Ltd., vs. Sulphide Corporation, Ltd., 31 R. P. C., 206, Privy Council British Empire. Minerals Separation, Ltd., vs. Hyde, 207 Fed., 956 (D. C. Montana). Hyde vs. Minerals Separation, Ltd., 214 Fed., 100 (C. C. A., 9th Circuit). Minerals Separation, Ltd., vs. Hyde, 242 U. S., 261. Minerals Separation, Ltd., vs. Miami Copper Co., 237 Fed., 609 (D. C. Delaware).

flotation advanced when the patentees entered it, having reached the commercial stage in only two processes, Elmore and Cattermole, representing respectively metal-flotation and metal-sinking processes, and having reached the stage of success in none.

The Elmore process was known as the bulk-oil or oil-buoyancy process. It required from 100% to 300% of oil on the ore—that is, from 2000 to 6000 lb. of oil to 2000 lb. of ore—and called for a gentle movement or agitation of pulp in a way that would bring the oil and metal in contact without breaking the oil bulk, and relied for metal recoveries on the buoyancy of the oil (due to the lesser specific gravity of the large volume) to raise and hold on the surface the metal which by affinity it had extracted from the ore. This was an oil-flotation process. It was not successful because the cost of the considerable quantity of oil used and not recovered made its practice commercially prohibitive.

The Cattermole process was just the reverse of Elmore. While this process depended upon the utilization of the same selective affinity of oil for metal, the quantity of oil was relatively small, being from 3 to 6% on the ore; but the agitation was considerable, having for its object not the retention of the oil in bulk as in Elmore, but its separation and thorough distribution through the pulp, with the object and result of causing the metal particles to be brought together and agglutinated with the metal slimes, forming granules of a size and specific gravity sufficient to cause them to sink, where they were recovered while the gangue was carried off the surface by an upflow. This was the metal-sinking process. It had a doubtful success in the concentration of copper and zinc ores of high metal content, but like the Elmore process it was impracticable because unprofitable for the concentration of ores of medium and low grades.

Discovery of First Patent

It was while the patentees were engaged in developing this process with a mechanical appliance known as a Gabbett mixer, by which the pulp was agitated, that the discovery of the first patent was made. It was found that when the proportion of oil was reduced below 2%, the agglutination of Cattermole ceased, and metal recoveries ceased also. This so disturbed the theory upon which the patentees were working that they at once embarked on a series of expriments, in which the quantity of oil was progressively reduced from the Cattermole proportion and the agitation varied in intensity and duration. In experiments with oil in proportions just under the Cattermole proportion nothing resulted. The Cattermole concentration was lost and no other concentration was obtained. When in the line of experiments, the proportion of oil to ore was reduced to 1.5%, a "float" appeared. At 1.04% "still more float" appeared. At 0.32% the "float vastly increased." At 0.1% the float again "vastly increased." It thus developed that in using oil at 0.1% or even at 0.05% on the ore, and after violently agitating the pulp from 2½ to 10 min., there arose to the surface when the pulp was brought to rest a thick froth or foam of oil-coated air bubbles carrying oil-coated metal particles to the extent of about 90% of the metal content, the foam being sufficiently stable to permit removal and metal recoveries.

This was an entirely new result based upon a phenomenon then unknown and still unexplained. It constituted discovery. It was a discovery that promised what has since been accomplished—a change in the art of oil flotation from laboratory experiments and mill failures to commercial success. Its great value especially in zinc and copper ore concentration met with world-wide recognition. The art immediately adopted it and paid tribute to it, either by yielding to the patents covering it or by challenging them in litigation commensurate in scope and importance with the field of the discovery itself. The grounds upon which the validity of the patents was attacked were, first, that the phenomenon was already known, and second, that the patents disclosed no novel means for reducing it to practical use. With the decision of the Supreme Court sustaining the validity of the patent, the two grounds of attack disappeared, leaving open, however, the question whether the discoverers have wholly covered their discovery by a patent, and if not, then how far have they appropriated it to their exclusive use, within the principle that in its naked sense a discovery is not patentable and can be embraced in and controlled by a patent only when and to the extent that its principle is developed into invention by the disclosure of a medium or means which brings it into practical action. Morton vs. New York Eye Infirmary, 5 Blatchf., 116.

The particular medium by which and through which the discoverers brought into practical action and put to practical use the principle of their discovery, is a process disclosed in their patent. The process described by the claims in suit, including the elements we have numbered and the distinguishing features marked, is as follows:

> 1. The herein-described process of concentrating ores which consist (1) in mixing the powdered ore with water, (2) adding a small proportion of an oily liquid having a preferential affinity for metalliferous matter (amounting to a fraction of one per cent. on the ore), (3) "agitating" the mixture "until" the oil-coated mineral matter "forms" into a froth, and (4) separating the froth from the remainder by flotation.
>
> 12. The process of concentrating powdered ore which consists in separating the minerals from gangue (1) by coating the minerals with oil in water containing a fraction of one per cent. of oil on the ore, (2) "agitating" the mixture "to cause" the oil-coated mineral "to form" a froth, and (3) separating the froth from the remainder of the mixture.

The claims disclose the process. The specification, as usual, throws light upon the process by distinguishing it from the prior art, describing its operation and result, and referring to illustrations of its practice in two apparatus, in one of which agitation and consequent aeration and fomentation are accomplished by mechanical means.

The validity of this patent and of its equivalent abroad has been widely attacked and ultimately sustained. As our task is to interpret the scope of the United States patent, we shall concern ourselves only with the decisions of the courts of this country.

The first suit on the patent was brought in the District Court of the United States for the District of Montana (Minerals Separation, Ltd., vs. Hyde, 207 Fed., 956). The validity of the patent was attacked on the ground of anticipation by the prior art, but the court held the patent valid and found invention in the novel and useful combination of oil, air and agitation. (Minerals Separation, Ltd., vs. Hyde, 207 Fed., 956, 961.)

The United States Circuit Court of Appeals for the Ninth Circuit, reversing on appeal the decree of the District Court, found the patent invalid, on the ground that its only novelty lay in the reduced quantity of oil, that this was an improvement only in degree and therefore did not involve invention. (Hyde vs. Minerals Separation, Ltd., 214 Fed., 100.)

The case was then removed by certiorari to the Supreme Court of the United States, and while there awaiting hearing, the action at bar was instituted in the District Court of the United States for the District of Delaware. (Minerals Separation, Ltd., vs. Miami Copper Co., 237 Fed., 609.)

In this case the District Court held the patent valid and infringed, finding (in opposition to the Circuit Court of Appeals for the Ninth Circuit) patentable invention in the use of oil in the minute proportion of the patent. Shortly thereafter the Supreme Court heard argument and entered a decree in Minerals Separation, Ltd., vs. Hyde, (242 U. S. 261) by which it reversed the decree of the Circuit Court of Appeals for the Ninth Circuit and held the patent valid, finding invention as we read the opinion, in the co-action of the critical proportion of oil and air effected by "an agitation greater than and different from that which had been resorted to before," resulting in a froth concentrate of economical value.

Effect of the Supreme Court Decision

Following the decree of the Supreme Court in Minerals Separation, Ltd., vs. Hyde, this case was argued before us. The decree of the Supreme Court, with its accompanying opinion in the Hyde case, materially changed the aspect of this case on appeal by contracting, and in a sense expanding, the issues as tried by the District Court. It disposed of the issue of validity, which had been vigorously contested in the court below. But in disposing of that issue upon grounds different from those upon which the District Court based a like judgment, the question of infringement was acutely enlarged. Upon the finding by the District Court that patentable invention resides in the critical proportion of oil, the admitted use of oil in that proportion by the defendant was manifestly controlling in its finding of infringement, although the defense extended to the whole of the defendant's practices. But under the finding by the Supreme Court in the Hyde case that invention resides not alone in the critical proportion of oil but also in air and agitation, we are called upon to construe the patent in the light of that finding and determine whether the defendant's practices of aeration and agitation in connection with its admitted use of the critical proportion of oil, are within or beyond the scope of the patent.

It is to be noted and kept in mind that the Supreme Court did not construe the patent or determine its scope, for it had no occasion to do so. In the case before it, infringement was so clear that it had to be found if the patent was valid. The validity of the patent, therefore, was the only seriously controverted issue before the Supreme Court.

In deciding the issue of validity, the Supreme Court disposed of the prior art as anticipations by reviewing by general classification its processes, together with the process of the patent, and in so doing used expressions which the parties have severally employed in support of and in opposition to their respective contentions. The plaintiff maintains that the language of the Supreme Court supports its broad contention, that "Whenever the modifying agent of the patent (oil) is used, a person infringes who gets air into the pulp in any fashion and agitates the mixture by any means to a sufficient extent to cause the mineral particles to attach themselves to air bubbles and to rise therewith above the top of the mixture in a collection of bubbles and metal particles, to wit, froth." The defendant maintains that the agitation in which the Supreme Court found invention, is agitation produced by mechanical means, and that anyone, who though using the modifying agent of the patent in the critical proportion, introduces air into the pulp otherwise than by beating it in, and who agitates the pulp to a metal-bearing froth by any means other than mechanical, or who otherwise obtains the result without any agitation whatever, is beyond the scope of the patent and escapes infringement.

Considered in the light of what the Supreme Court said and what it did not say, it is clear that the positions of both parties are extreme. The contention of the plaintiff at least omits the very definite limitation of the patent to the results obtained by the use of oil within the described proportions, and also the equally definite disclosure of an agitation in violence and duration greater than before employed, while the defendant misinterprets words of description as words of limitation.

The Supreme Court said, that

> The process of the patent in suit, as described and practiced, consists in the use of an amount of oil which is "critical" and minute as compared with the amount used in prior processes . . . and in so impregnating with air the mass of air and water used by agitation—"by beating the air into the mass"—as to cause to rise to the surface of the mass, or pulp, a froth particularly coherent and consistent in character. . . .

By this expression the defendant maintains that the Supreme Court did not merely repeat testimony describing and showing how the process was practiced, but used the words as their own, and thereby interpreted the patent and limited its scope to the introduction of air into the pulp "by beating the air" into the pulp by the specific mechanical means illustratively shown by the drawings of the patent. We do not so interpret this expression. In the first place the patent nowhere uses the words "by beating the air into the mass." Therefore these words as quoted by the Supreme Court, were not quoted from the patent, but were taken from the testimony of a witness who used them in describing the process as discovered and developed by the patentees. This being so, we do not think these words, as used by the Supreme Court in describing the process, can be construed as a limitation upon the process.

Buoyancy of Air Bubbles

It further apears that the Supreme Court, in distinguishing the process of the patent from processes of other patents relied on as anticipations, found that the lifting force which separates metallic particles of the pulp from other substances resides chiefly "in the buoyancy of the air bubbles introduced into the mixture by an agitation greater than and different from that which had been resorted to before." By this expression the defendant insists that the court explicitly limited the patent to agitation caused by mechanical means, thereby excluding from its scope such agitation by pneumatic means as was used in part in the defendant's practice. As this expression is susceptible of an entirely different meaning, presently to be considered, we find nothing said by the Supreme Court which indicates that it limited the agitation of the patent to agitation by mechanical means.

The defendant further maintains that the Supreme Court gave to the patent a narrow construction when it used these words:

> While we thus find in favor of the validity of the patent, we cannot agree with the District Court in regarding it valid as to all of the claims in suit. As we have pointed out in this opinion, there were many investigators at work in this field to which the

process of the patent in suit relates when the patentees came into it, and it was while engaged in study of prior kindred processes that their discovery was made. While the evidence in the case makes it clear that they discovered the final step which converted experiment into solution, turned failure into success (The Barbed Wire Patent, 143 U. S., 275), yet the investigations preceding were so informing that this final step was not a long one and the patent must be confined to the results obtained by the use of oil within the proportions often described in the testimony and in the claims of the patent as "critical proportion" amounting to a fraction of 1% on the ore. . . .

We are inclined to the opinion that by this expression the court intended a limitation only upon that one feature of the patent to which the expression was addressed. The District Court had held valid certain claims in which the proportion of oil was described simply as "a small quantity," and the Supreme Court in reversing that finding and holding those claims invalid, used the quoted words of limitation in confining the patent to the results obtained by the use of oil in the proportions of less than 1%.

From this recital of the litigation of the invention of the first patent it appears that in construing the claims of the patent we are greatly aided by the opinion of the Supreme Court in being told with authoritative finality that the process involves invention and in being shown in which of its elements invention resides; but it is equally clear that in determining the breadth and scope of the claims, we are without the aid of any adjudication in which their scope has been decided or even considered.

The elements of the patent in which invention is found are oil, air and agitation. These were old in the art, possessing as we have shown, known characteristics and functions, and had they performed in the process of the patent no new or different function or had they produced no new or different result, it is clear they would have anticipated the patent and defeated its claim to invention. But a finding by the Supreme Court that the invention was not anticipated by the old uses and results of these elements is in effect a finding that these elements as used in the process of the patent perform or develop new uses and functions or produce different results. And such we find to be the fact.

The invention, as we have said, is founded upon a discovery. Its patentability depends upon the medium disclosed in the patent by which the force or principle of the discovery is brought into action. Three new uses of old elements are disclosed by the patent, producing a new result. The first relates to oil.

The affinity of oil for metal was known, and though old, was employed in the invention; but that this affinity in a given condition is greatest when its quantity is relatively least or that the affinity increases with the decrease of oil below a given quantity (less than 1%) is the soul of the discovery and was wholly new. But the discovery did not consist of this alone.

(To be concluded)

The Last Flotation Decision

The decision of the majority of the Circuit Court of Appeals in Philadelphia in the case "Minerals Separation, vs. Miami Copper Co.," impresses us as being the most lucid review of the history of the development of this art, the standing of the several patents, etc., that has been offered by any of the courts that have adjudicated on the flotation litigation. In the interest of our readers, we are, therefore, publishing the Philadelphia decision in full. We have received several communications respecting the Philadelphia decision. Two of them are as follows:

The notable feature of the Philadelphia decision was that although it was agreed that the Supreme Court had neither construed the first patent nor determined its scope, both the majority and the minority of the Philadelphia Court had great trouble with words of description in the Supreme Court decision. The majority nevertheless reached the conclusion that all of the operations of the defendant, including the Callow operations, were infringing operations as to the first patent in suit, and the unanimous opinion of the Court as to the breadth of the second patent in suit leaves no loophole for any variation of Callow procedure which shall escape that patent. As a matter of fact there is likewise no loophole as to the first patent.

Judge Buffington gave a dissenting opinion which was founded upon the belief that the identical cone mixer of the Gabbett patent was used by Minerals Separation, Ltd. at the time of the discovery. Had Judge Buffington examined the cone mixer in evidence with a little care he would have observed that the inner ribs of the cone as shown in the Gabbett patent were omitted from the cone mixer as used by Minerals Separation Ltd., and all of his reasoning was founded upon the air-beating action of these inner ribs, which unfortunately for his reasoning were not used by the inventors of Minerals Separation.

The article in the *Journal* of June 2 fairly described the proceedings at Butte. In the index, however, the error was repeated that the Supreme Court limited the patent "to use of oil in the proportion of a fraction of 1% on the ore." The Supreme Court did not so limit the patent, but only to a process wherein the "results obtained" were substantially the same new results as were first obtained in the history of metallurgy by the process of the patent when the discovery was made in March, 1905. The article itself, however, clears this matter up thoroughly.

HENRY D. WILLIAMS.

New York, June 2, 1917

I have before me the printed opinion of Judge Woolley, U. S. Court of Appeals, Third District, in the case of Minerals Separation vs. Miami Copper Co., and also the *Engineering and Mining Journal* of June 9. The *Journal's* account of the decision, p. 1024, is distinctly misleading. The court decided that at one time in our operations when we used a centrifugal pump and made a break in the circuit by permitting the pulp to drop through the air into a Pachuca tank and then agitated it in the Pachuca tank this was agitation in the sense described in the first patent suit. In the meantime finding such procedure unnecessary and in fact detrimental we changed to treatment of material directly in Callow cells, concerning which the court says "If the only agitation to which the pulp was subjected after such agitation as in the prior art was necessary to mix the oil and ore was the agitation of the Callow cell we would not say that that agitation amounted to or was the equivalent of the violent agitation of the patent disclosure and constituted infringement." With the above state of facts and the decision quoted we are not infringing Minerals Separation patent. Other mines to my personal knowledge are operating with more than 1% of oil and not infringing. I think the *Journal* ought to give a careful abstract of the decision, adding these facts.

J. PARKE CHANNING,
Vice President, Miami Copper Co.

Butte, Mont., June 12, 1917.

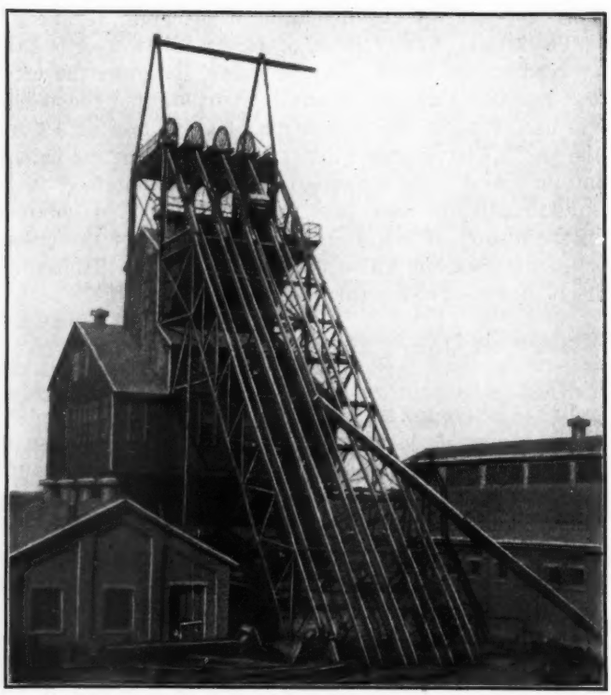
Details of Practical Mining

Hoist Record at Palmer Shaft

By H. H. Hodgkinson*

The concentration plant of the New Jersey Zinc Co. at Franklin, N. J., is supplied with ore by means of a single four-compartment shaft known as Palmer shaft, which delivers the ore direct to the crusher house. Formerly the ore was hoisted through a number of shafts distributed about the town, which necessitated further handling in railroad cars before reaching the company's mill.

Palmer shaft was sunk at an angle of 47° 30′ with the horizontal, and is 1510 ft. deep measured on the slope from the collar. Ore is hoisted through two of the compartments, the skips being balanced (one dumping while the other is being loaded at the pocket). The



SHAFT-HOUSE AND PALMER SHAFT

other two compartments are used for men, timber and supplies exclusively, but are equipped with ore-loading pockets at the 800-ft. and 1150-ft. levels so that ore can be hoisted through them if necessary.

Two 22 x 48-in. duplex, direct-acting, double-drum (one fixed and one loose) corliss hoisting engines made by the Allis-Chalmers Co. are used. The drums are grooved for 1⅛-in. steel rope and are 10 x 5 ft. 6 in. The head-frame sheaves are 12 ft. in diameter, and the rope is supported in the shaft by special 9-in. idlers at spaced intervals of 25 ft. Steam at 145 lb. per sq. in. gage pressure is admitted to the cylinders and is cut off at about nine-tenths stroke, and at present exhausts to the atmosphere at a maximum rate of approximately 42,000 lb. per hour. An installation of a Rateau steam "regenerator" or "accumulator" is contemplated in order to capture this exhaust steam for utilization in a mixed-pressure turbine.

There are three ore pockets in the shaft from which the ore is hoisted. These are equipped with a loading device designed by R. M. Catlin, superintendent, which makes it possible to load a skip of ore in 10 sec. This device requires the services of two men and is operated by hydraulic pressure obtained from the pump column pipe.

The surface, or top, pocket is 191 ft. from the tipple and is used for handling any foreign ore shipped in to be treated. The 800 ft. level pocket, which is 1122 ft. from the tipple, has a capacity of 1340 tons and is used to handle the ore mined on and above the 750-ft. level. The 1150 ft. level pocket, of 170 tons capacity handles all the ore mined below the 750-ft. level, and is at a distance of 1610 ft. from the tipple.

The record hoist for the shaft was made on July 14, 1916, by one engine, when 3079 tons (2000 lb.) of rock and ore was hoisted during a period of 10 hours actual hoisting time. Of this tonnage 2542 tons was hoisted from the 800-ft. level pocket and the remainder (537 tons) from the 1150-ft. level pocket. The total number of skips hoisted during this period was 500, or 50 skips per hour at an average of 6.158 tons per skip. There were 307.9 tons of pocket ore hoisted per hour from an average hoisting distance of 1202 feet.

The largest tonnage hoisted in one day of 14½ hours actual hoisting time occurred Feb. 4, 1916, when 4256.57 tons of rock and ore were hoisted from the 800-ft. loading pocket, which is 1122 ft. from the tipple. The total number of skips hoisted during this period was 780, or an average of 53.79 skips per hour, at an average of 5.457 tons per skip. Tons hoisted per hour were 293.5.

The maximum tonnage for any one month from Palmer shaft was made in May, 1915, when 76,017.78 tons of rock and ore was hoisted, of which 73,114.71 tons was Franklin ore, 469.9 tons Sterling Hill ore, and the remainder (2433.17 tons) rock rejected from the picking table.

*Box 1536, Jerome, Ariz.

Cost of the Rogers Pass Tunnel

The building of the longest railway tunnel on the American continent, and a double-track tunnel at that, according to *Engineering and Contracting,* cost less than $150 per ft., inclusive of a concrete lining for 30% of its length. This is a record to be proud of, as the work of driving this five-mile tunnel through hard rock (quartzite and schist) was completed six months ahead of the 3½-year time limit.

The cost includes the contractor's profit of 10% allowed on all expenditures. It includes lining 1½ miles of the tunnel with reinforced concrete. It includes the driving of nearly 4 miles of 7 x 8-ft. pioneer tunnel

and crosscuts to the main tunnel. It includes all preliminary costs, superintendence, etc. It includes liberal bonuses paid to the men, about which a word will be said later.

Since there was about 30 cu.yd. of excavation per lineal foot of double-track tunnel, the cost of $150 per ft. is about $5 per cu.yd. of excavation. But this, be it remembered, includes concrete lining for 30% of the tunnel length.

The highest record of progress on one heading of the Pioneer tunnel (7 x 8 ft.) was 922 ft. in one month. Part of this high speed is attributed to the use of hammer drills, but excellent management and the payment of a bonus to the workmen account very largely for the record-breaking performance. In the main headings it was found that after the introduction of the payment of a bonus to the men for progress in excess of 450 ft. per month, nearly 25% greater speed was secured. The men engaged in enlarging the headings were also paid a bonus, but in this part of the work the number of feet of hole drilled by each man constituted the basis for the bonus payment.

Summing up the reasons for the rapid progress and low cost of the Rogers Pass tunnel, they seem to us to be: First, the method of tunneling, involving the driving of a pioneer tunnel off the line of the main tunnel; second, the excellent administration of the work; third, the payment of liberal bonuses to the workmen, which bonuses were adhered to; fourth, the use of hammer drills.

The Simplon tunnel through the Alps is nearly 12 miles long, and after 6½ years' work was finished in 1905, breaking all preëxisting speed records for hard-rock tunneling. The best month's record on a heading was 685 feet.

A Survey Stake That "Stays Put"

The ordinary survey stake as used by the engineer is so made as to be very easily knocked out of position. This defect is due to the way in which the stake is sharpened, says N. S. Mulligan, of Thomasville, N. C., in the *Engineering News-Record.*

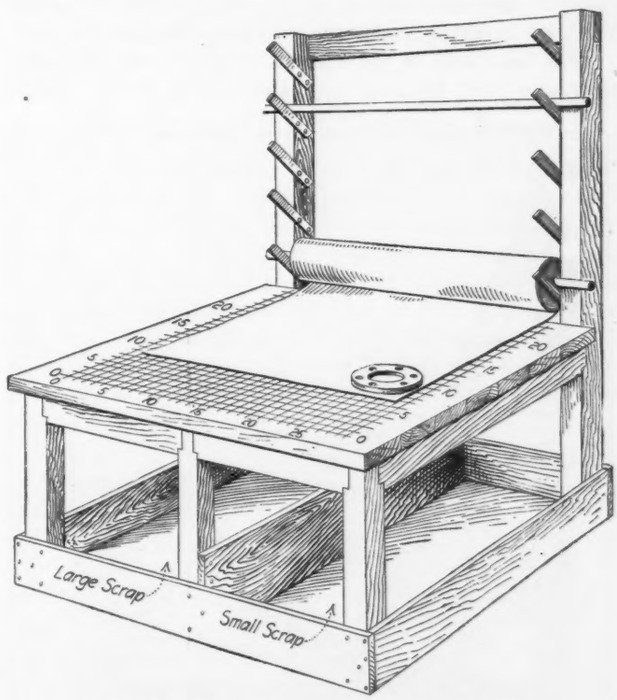
The stake sketched on the left-hand side of the accompanying figure is sharpened in the manner most generally in use and may be described as a straight stick sharpened only near the end with a short slope from both sides. When such a stake is driven, the point is the only part firmly seated, for the body of the stake is as large just above the point as the rest of the way up, so that the stake just stands in a hole made by the point. This shape accounts for the ease with which most stakes are displaced. If the stake be made of the form shown by the figure at the right, it will be found to give greater satisfaction. This stake is sharpened only on one side, but the slope extends three-fourths the length of the stake. When driven into the earth, the stake is held very much more firmly than is the other kind, because the taper is much longer and therefore the earth adheres to a greater length of the stake. It is very difficult to draw this type of stake out of the earth when once driven in. If exposed to traffic, as in the case of streets and highways, the stakes are sometimes broken off at the ground, the stake breaking before it pulls up. In this case the point is still in position and can be found and replaced.

WRONG AND RIGHT WAY

On one occasion a test was made of these two types of stakes on a highway on which the traffic was very heavy. The following was the result: Equal numbers of the two kinds of stakes were used, under equal exposure, yet 14 per cent. of the first type and only 2½ per cent. of the other type were lost.

Rack and Bench for Packing

The illustration shows the construction of a bench for sheet packing, which is particularly useful in small plants purchasing from a distance, and in large plants keeping a supply independent of the main warehouse. Several kinds and thicknesses can be kept on the rack and the desired packing pulled out on the bench and cut to size, using a straight-edge and the scale of inches marked across the bench. In case of small flanges that can be brought in, the bench is made heavy enough so that the packing can be cut directly from the flange either by marking or peening. The under part of the bench is divided into two compartments, one for large and the other for small scraps.—*Power.*



SHEET PACKING KEPT READY FOR USE

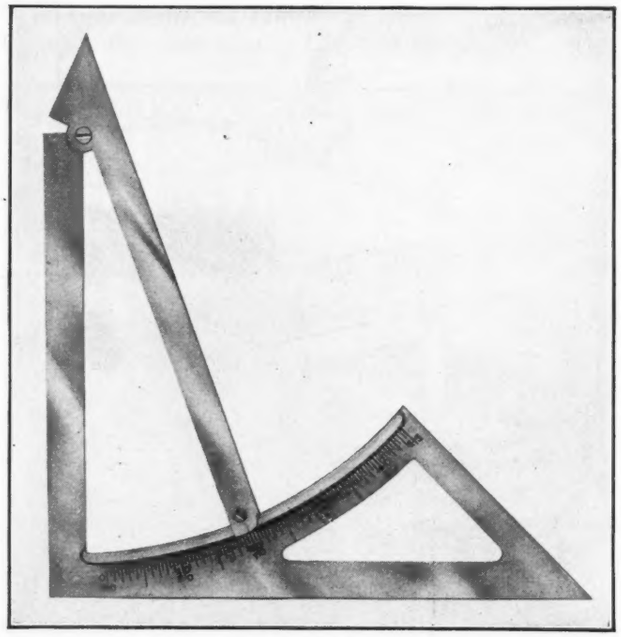
Temporary Sumps occasionally have to be dug, often close to the shaft where the rock has been shattered by heavy blasting, often in soft ground which will not hold water. An old yet simple method of making such a sump water-tight consists in constructing a rough box which may be set solid in the sump and lining it with P & B or other roofing paper. Care must be exercised to have both floor and walls free from knotholes and irregular edges occasioned by different thickness of boards or plants, and it is advisable to cleat the paper in place, administering a good dose of P & B paint under and along the cleats. A board or two along the bottom of the lined sump will prevent injury from tools or rock which may fall or be dropped in, and if receiving the discharge from a pump or a heavy flow of water, a baffle is desirable. It must be taken for granted that this kind of sump cannot be subjected to a shovel cleaning. Tanks can be constructed in the same manner as the sump.

Mining and Metallurgical Machinery

Universal Triangle

The adjustable triangle shown has recently been brought out by Charles E. Baker, Indianapolis, Ind., and is known as the Hellman universal triangle. It is made of nickel-plated steel in 6-in. size and is $\frac{1}{8}$ in. thick. As may be seen, the instrument consists of a 45° triangle, a part of the hypotenuse of which is hinged in such a manner that it may be adjusted to form any angle from 0 to 45° with one side or an angle of from 90 to 45° with the other side, says the *American Machinist*.

The loose end of the hinged section is provided with a groove that fits over a tongue milled at the proper



UNIVERSAL TRIANGLE

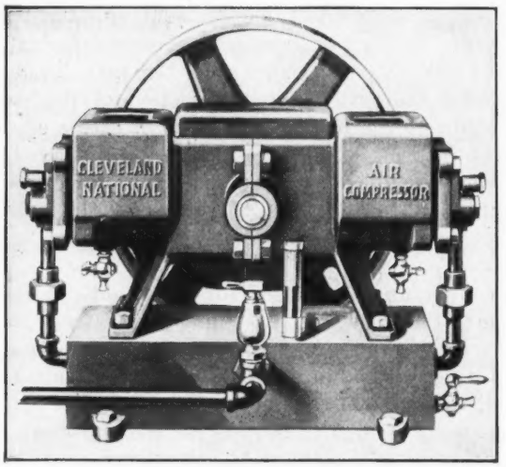
radius in the body of the triangle. Friction is relied upon to hold the hinged section in the proper position. The protractor is graduated to $\frac{1}{2}$°. The whole device is flat and can be used either side up, there being no projecting screws or nuts to interfere.

Air Compressor

The air compressor illustrated has been placed on the market by the National Motor Supply Co., Cleveland, Ohio. It is of the double-opposed type, with a 2-in. bore and a $2\frac{1}{2}$-in. stroke, both pistons and the yoke being cast in one piece. The crankshaft is a drop-forging, and all bearings are bronze bushed.

Water-cooled cylinders are used. Both inlet and outlet valves are contained in the cylinder heads, which may be removed without disturbing either the cylinders or the pistons. From the cylinders the air is pumped to an auxiliary base tank that contains a series of baffle plates for removing oil and moisture.

A check valve is placed between the base tank and the main storage tank; and when the compressor is stopped, the air gradually escapes from the small base tank. This acts as an unloader and allows the compressor to get up

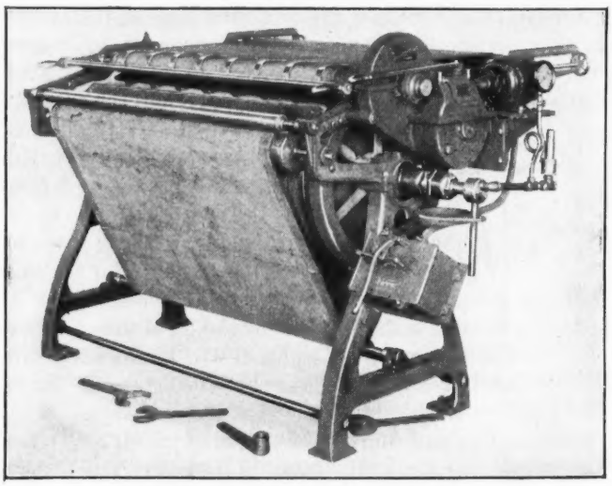


AIR COMPRESSOR WITH DOUBLE OPPOSED CYLINDERS
Cylinders, 2 x 2½ in.; capacity, 5 cu.ft. of free air per min.; horsepower required, ½

speed, when again started, before having to pump against the full pressure in the main storage tank. The machine can be supplied for either belt or motor drive, and either with or without automatic pressure regulator.

Blueprint Ironer

The blueprint ironer shown in the illustration, consisting of a heated 20-in. cylinder under which all types of prints are carried directly from the wash water, emerging smooth and dry, is being manufactured and placed

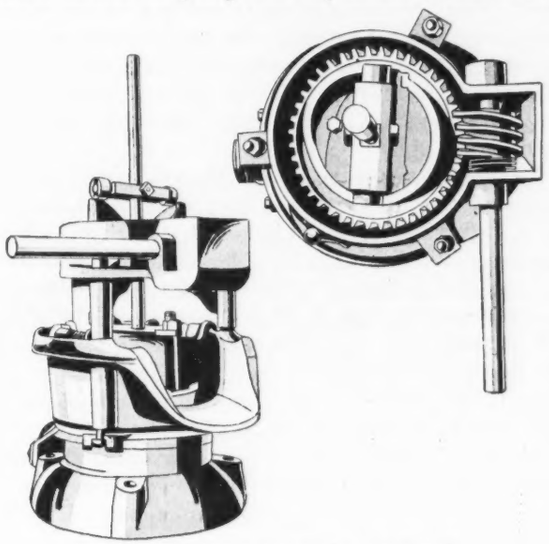


BLUEPRINT IRONING MACHINE

on the market by the American Laundry Machinery Co., Cincinnati, Ohio. Two sizes are made, 40 and 60 in., and either size may be heated by steam, gas or electricity.

Worm-Drive Power Diaphragm Pump

A new type of power drive for diaphragm pumps has been placed on the market. The drive comprises a worm gear and cam lift in a frame interposed between the pump rod and the source of power, which may be a gasoline or steam engine or an electric motor. The engine turns a horizontal shaft carrying the worm gear. The worm drives a circular gear and rotates a ball-cam lift whose follower carries the pump rod. By means of this cam the



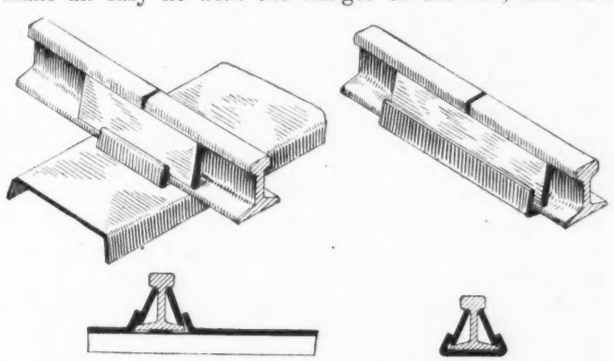
WORM-DRIVEN DIAPHRAGM PUMP

reversing of the stroke can be accomplished without shock or vibration, so that the pump needs no ballast.

The driving mechanism is made to be readily attached to any stock diaphragm pump without alteration; it is said that the change can be made in half an hour. The power may be applied either by belt or direct connection. The price of this attachment is $100, and that of the pump complete on a platform with a 2½-hp. gasoline engine is $175. The pump and drive alone is sold for $125. The device is made and the patents are owned by the Clinton Power Pump Co., Clinton, Mass.

New Track and Rail Joint

A jointing device, consisting of a baseplate, 6 in. long, of ⅛-in. steel plate, with longitudinal flanges formed to make an easy fit with the flanges of the rail, and two



WEDGED TRACK JOINT

wedges of $\frac{3}{16}$-in. plate having a taper of ¼ in. per ft., which are wedged between the under part of the rail head and the flange of the baseplate, the wedges being placed on each side of the rail, is described by L. W. Macer in the *Journal of the Chemical, Metallurgical and Mining Society of South Africa.*

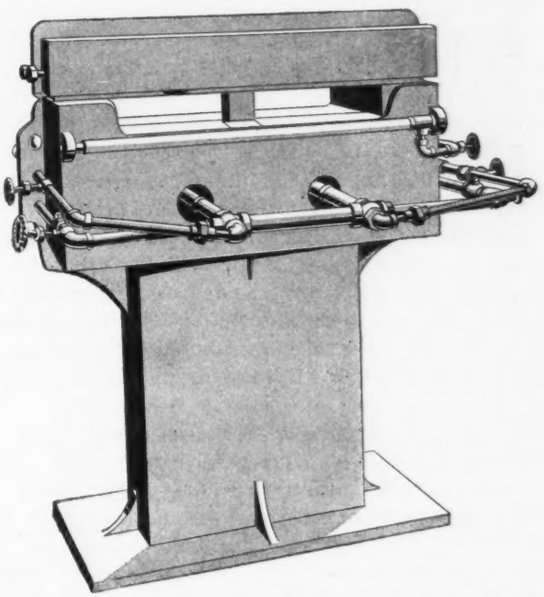
If attached to steel ties, the base is formed by punching up lugs in the ties to form flanges to receive the wedges, and an advantage is gained by making joints on the ties, giving greater permanency of alignment of track. The rails can be supported between joints by wooden ties to which they are dog-spiked or by lighter steel ties, using only one wedge.

Wedge joints, stamped from sheet steel, weigh less than fishplates and bolts, the wedge joint for 16-lb. rails weighing 3 lb. 2 oz. against 4 lb. 3 oz. for fishplates and bolts. The steel tie is also simpler, as it avoids the necessity of clutch bolts. The triangular section formed by the wedges and baseplate is of great strength.

The speed of track laying is greater than with plates and bolts, and where scrap material is available for their manufacture, wedge joints are easily made at the mine with a die and steam hammer.

Oil or Gas Drill-Heating Forge

The Ajax oil or gas forge, built by T. H. Proske, Denver, Colo., is a new departure, by reason that it is two forges in one, having two burners and two fireboxes. This forge when used as one complete unit will heat drill steels fast enough to keep two drill-sharpening machines in rapid operation. One side of it may be used for heating steels for sharpening and the other side for tempering. If only a few steels are to be sharpened, only half of the forge is used. Each side



DOUBLE FIREBOX OIL OR GAS HEATER FOR DRILL STEEL

will hold from five to eight steels. If both burners are used, the fuel used does not exceed that of any other forge of equal capacity.

Another feature of this forge is its narrow firebox. In sharpening steel is it not desirable to have the heat on the steel exceed 3 in. in length. The firebox is only 2½ in. deep, and in making collars and lugs for shanks the heat can be applied in the desired place on the steel. Valves for controlling the burners are placed at the side, in easy reach of the operator. The net weight, bricked complete is about 750 pounds.

Correspondence and Discussion

Copper-Silver Leaching

The article by Joseph Irving on leaching, in the *Journal* of May 26, 1917, is interesting and recalls several leaching plants still in operation in Bolivia. There are four—no two alike. No. 1 is the most interesting. The ore, after being ground dry in ball mills, is roasted in hand-rabbled furnaces and chloridized in the same furnaces. It is discharged to cars, and while still hot is tipped into small, square leaching tanks made of wood and filled with brine. As silver, gold and copper chlorides are soluble in the resulting solution, it is only necessary to draw off the solution. This solution runs through an interminable series of precipitation launders. The first of these are filled with copper for precipitating the silver, the remainder being stocked with scrap-iron for the copper. No attempt is made to keep the silver and copper cement separate, the mass being sold as dried.

The process is simple and effective and has the advantage of requiring a minimum of attention. La Placa gave me the results and assays, but as I have no silver mines and as they talk in "marcos" and "cajones" and "quintales" in Bolivia (metric cranks please copy), his details were underexposed on my mental film.

The leached ore is then concentrated by hand for the tin content. Some day soon there will be a fine plant of Diesel engines and up-to-date concentration and crushing machinery at this plant. At present the small amount of power required is supplied by an old ship's steam engine; steam is produced in boilers using manure for fuel.

No. 2 plant roasts in Kauffmann furnaces, and the attempt is made to chloridize in the same furnace. There is no difficulty in chloridizing, the difficulty being to prevent the chloridizing of the entire furnace! The arms, teeth and shaft must be replaced frequently, and now that spares are not obtainable from Germany (thank God!), Mr. Blank is looking around for some type of furnace to replace, or at least to supplement those he has.

This plant is running in Huanchaca and is the last surviving unit in a once prosperous town. The streets, the plaza and the houses—the shops, warehouses and schools—all are as deserted and as quiet as a New York office building on Sunday. The surrounding hills have long, snake-like smoke flues running up their flanks—broken backed, caved and in ruins. The one flue in operation is a mile long and spews smoke every few yards. It looks like an artillery trench in action.

No. 3 plant is just a simple, standard hypo leaching plant, shipping a ton or two of silver—frequently. Don Luís built it before I was born, and he and the plant are as good as ever. Of course he could substitute a wood-frame filter press for the cotton-cloth cone filters used now, and I nearly urged one upon him, but at No. 4, I saw such a press in the yard unused, the bags being preferred, so it would not be good business to urge the point. Mr. Sohnlein prefers the bags as more convenient, quicker to empty and cleaner.

This precipitation plant of Sohnlein's for copper is simple, and one man runs it. Scrap iron of all kinds is used. Every once-in-a-while (I would give the exact interval, only he has probably changed it since my visit), the attendant shuts off the solution, pulls a few plugs and with a hose washes out most of the precipitated copper into a settling tank. The scrap iron is not touched by hand.

A big McDougall roasts the low-grade ore, the high-grade and roasted low-grade being treated in hand furnaces. Just now Mr. Sohnlein is erecting a Merton furnace in which he will try chloridizing. It has the advantage that a charge can be detained and chloridized without stopping the roasting elsewhere in the furnace. Mr. Sohnlein also says that the furnace may have some disadvantages that were not mentioned by the manufacturer. However, if it is a success, all the other hand furnaces will be similarly equipped.

All of these plants are so far from farms that smoke farming has not been tried. It is a fact, however, that hundreds of arrobas (or quintals or cajones—I don't remember)—anyway, all of these companies loose a lot of silver—besides the loss they are willing to admit. If there were any means of communication between these operators and those who control the Cottrell process, someone might make a commission by "getting it over" to the Cottrell people.

MARK R. LAMB.

New York, June 1, 1917.

Rapid Deposition of Galena

There is a general idea that the deposition of lead and other ores is a relatively slow process and involves a long period of time as measured historically and even requires considerable time from the geologic standpoint. Recently an example came to my notice which shows that it is a much more rapid process when favorable precipitants are present, even if the mineral-bearing solutions are very dilute. In fact, it suggests that workable deposits may have been formed well within historic times, when precipitating conditions have been favorable.

For some samples of old iron tools were recently found to be very liberally incrusted with galena crystals on unwatering a mine that had been abandoned for about ten years in the Lincolnville district that lies on the eastern edge of the Miami zinc and lead field, in northeastern Oklahoma. This district was opened about 15 years ago as a new field, but as the lead and zinc ore was found to be very low-grade, or to yield 1 to 2% of zinc (as sphalerite or "jack") and lead (as galena, or the sulphide), it was generally abandoned about 10 years ago when the bottom dropped out of the ore market. The recent great advance in ore prices has resulted in the reopening of some of the abandoned mines, from one of which the iron tools coated with galena were obtained.

This mine was under water for about 10 years and operated at a depth of about 80 ft. in the thin sheet or

chert ground that is characteristic of the Lincolnville district. A 3-in. railroad spike from the bottom of the mine in my possession illustrates the type of occurrence of the "Ten Year Lead Deposit. The spike is badly corroded and is incrusted to a depth of ¼ to ¾ in. with a mixture of limonite, (sesqui-oxide of iron) and galena. The galena is intermixed throughout the limonite as crystals—cubes—which are $\frac{1}{16}$ to ½ in. in size and which decidedly predominate in the amorphous limonite. If the tightly adhering mixture was scraped off, it would probably assay from 30 to 45% lead.

The metallic iron in the spike, shovels, etc., was an unusually good precipitant, but probably was little if any better than the organic matter that is so prevalent in the disseminated lead-bearing dolomintes of the southeastern Missouri district, or the oil and gas that was probably the precipitant in the Miami district of Oklahoma.

That my informant was essentially correct as to the time the iron was under water is attested by the short time that has elapsed since the Lincolnville district was discovered and the brief age of its boom period.

I have observed other similar instances of recent and comparatively rapid ore deposition in some of the older Joplin mines (lead and zinc), but the facts were not so satisfactory as to the time during which the mineral-bearing waters were depositing the lead and zinc, nor were the deposits so rich. H A. WHEELER.

St. Louis, Mo., May 25, 1917.

Pachuca Tank Air Connections

I like the description of the piping of the Pachuca tank that appeared in the *Journal* of May 26, 1917. May I suggest, however, that the outside air pipe should be longer, reaching and touching the edge of the lift tube. When in use, part of the air will go up inside and part outside the lift tube. Starting is almost instantaneous, even with settled concentrates. The lift tube itself should be shorter and should reach only near the surface.

As I am one of the several hundred who have the nerve to improve on Mr. Brown's invention, I feel a proprietary pride in seeing it described.

It is interesting, pleasant and gratifying to note how few plant superintendents realize the small quantity of air and low pressure required to operate these tanks. One manufacturer supplied a 6-in. air main for three tanks 8 x 25 ft., 20 ft. from the 8-in. twin compressor.

At the same plant the operator had some difficulty in starting his charges at first, and so for months ran his compressor at 60-lb. pressure, not realizing that the pressure at the pipe end in the tank was exactly the same as though his compressor were working at 10 pounds.

New York, June 2, 1917. MARK R. LAMB.

Extension Arm Clamp for Drills

The description of an extension clamp or column by a South American correspondent, appearing in the *Journal* of Apr. 28, seems to be almost exactly the same as our own contrivance of the same sort. We have built this arm for four or five years past and have described it in our catalogues. It is certainly a very practical and convenient form of mounting, for small tunnels particularly.

SULLIVAN MACHINERY CO.

Chicago, Ill., May 4, 1917.

The Cascade Flotation Machine

In the accompanying photograph there are shown some further details of the cascade flotation machine described in my article in the *Journal* of May 19, 1917. This photograph shows an installation not yet completed and lacks the skimmers and the froth aprons. There are two tiers of cells, two cells to each box, formed by inserting a partition, as may be observed in the lower box. The feed aprons, discharging one cell and feeding the next

CASCADE FLOTATION MACHINE

lower one, are shown, and the froth launders for each cell, sloping across the front of the cell and delivering into the froth collecting launder at the left of the photograph. Lever spigots, two to each cell, are shown, each pair joined by a rod so that they work together.

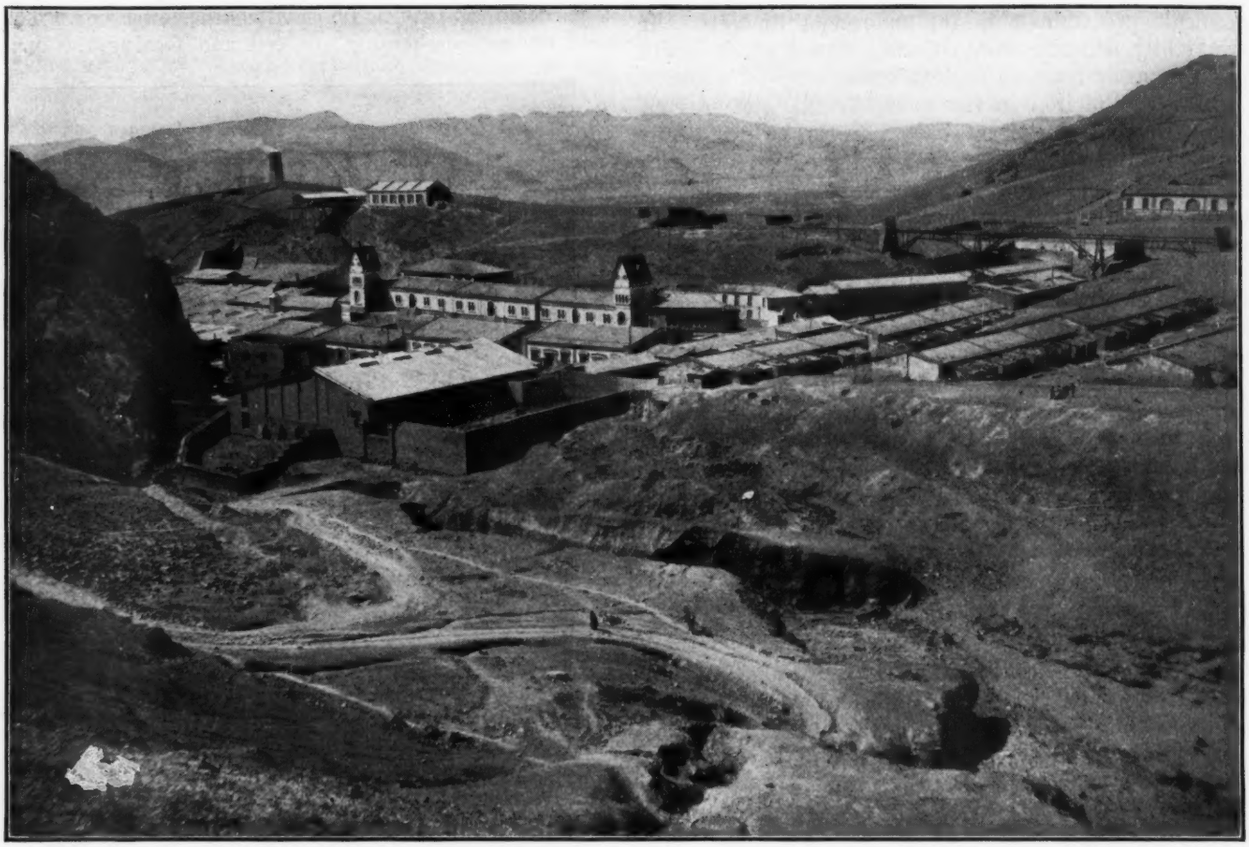
Ouray, Colo., May 10, 1917. CLIFFORD R. WILFLEY.

Poisonous Gases in Warfare

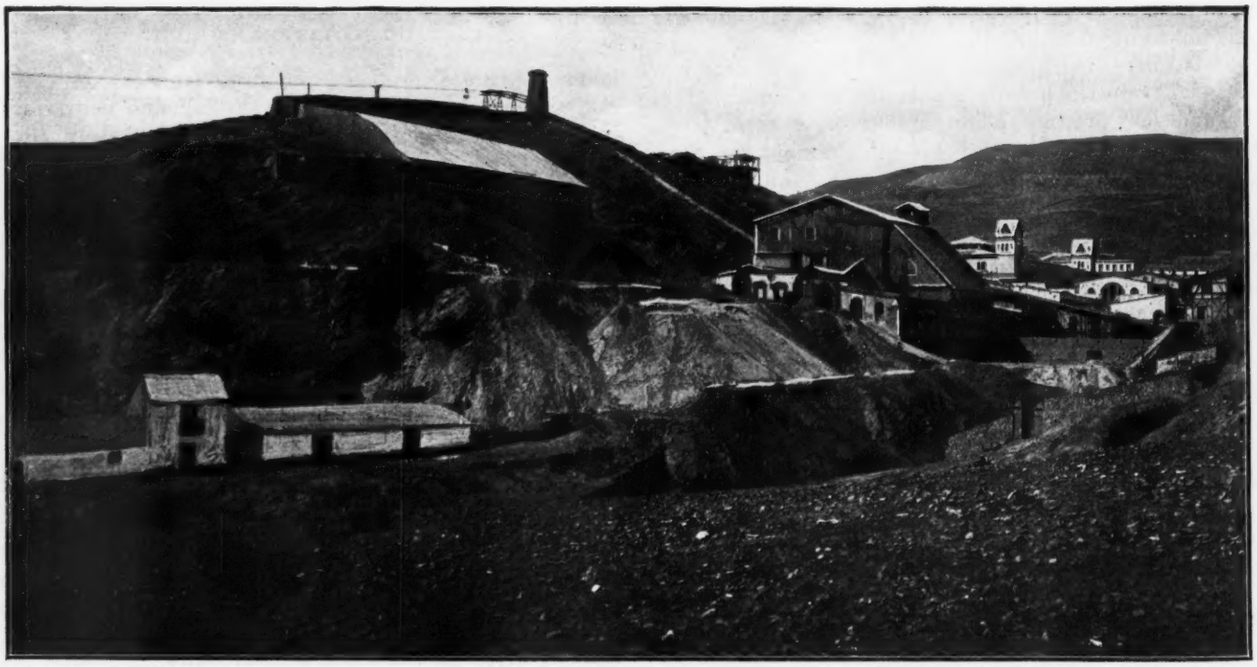
Regarding the "By the Way" item in the *Journal* of May 19, regarding poisonous gases in warfare, the list of gases used is somewhat longer than is there given. In addition to those listed, that is, chlorine, bromine, "sulphur fumes" and formaldehyde, it seems positive that hydrochloric acid, carbon monoxide and nitrogen peroxide have been used. It is highly probable that chlorine dioxide, nitrosyl chloride, carbonyl chloride, hydrocyanic acid, cyanogen chloride, and cyanogen bromide are being used. There is some reason to believe that the following have been or are being tried: Sulphureted hydrogen, phosphine, arsine, stibine, the mercaptans, as well as about a dozen rarer gases.

New York, May 29, 1917. DONALD M. LIDDELL.

Photographs from the Field

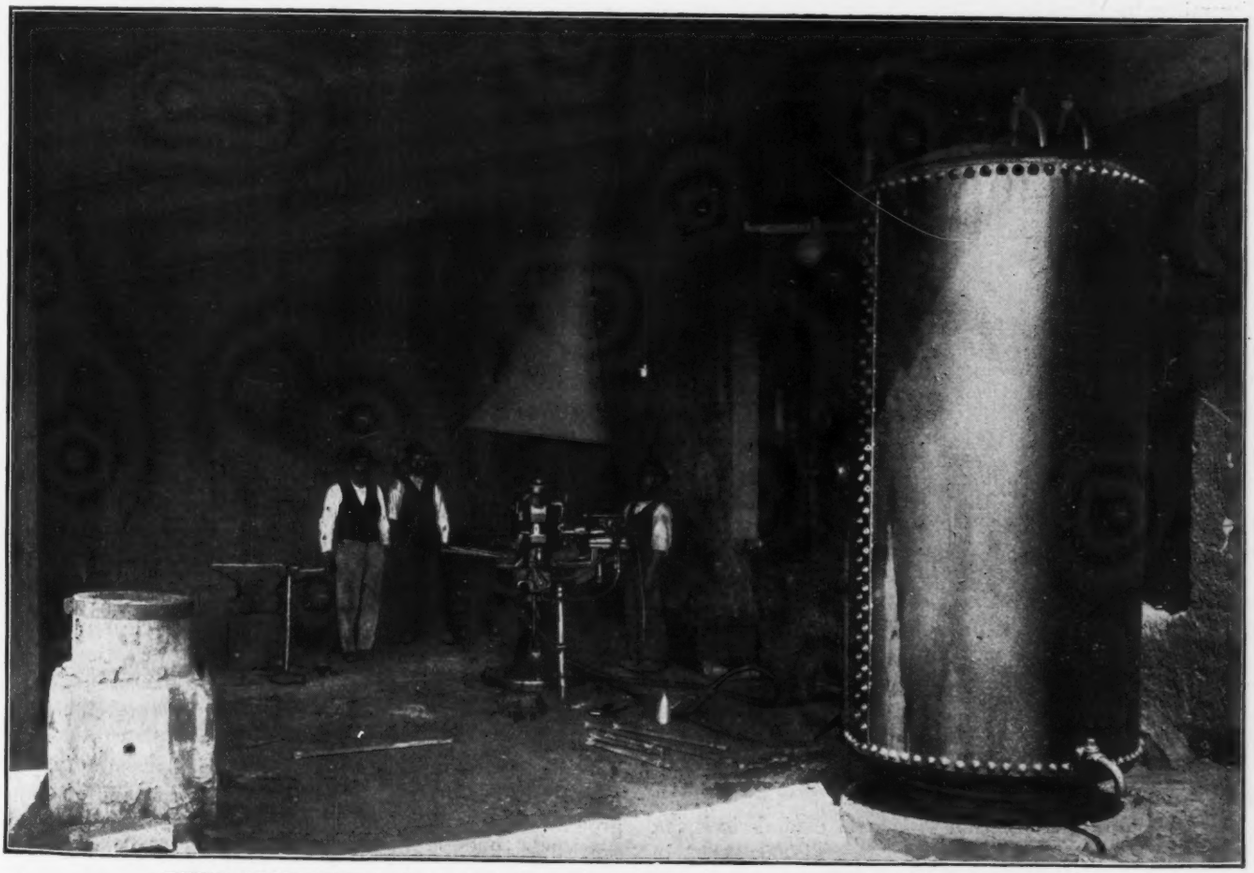


MIRAFLORES MILL AT UNCIA, BOLIVIA, FOR TREATING ORE FROM PATIÑO TIN MINES



VICTORIA MILL, TRAMWAY TERMINUS AND MIRAFLORES MILL AT UNCIA, BOLIVIA

CLEANING WOLFRAM ORE AT THE KAMI MINE IN THE CHICOTE MOUNTAINS, BOLIVIA



DRILL-SHARPENING SHOP OF THE CIA. MINERA DE ORURO, NEAR ORURO, BOLIVIA

Events and Economics of the War

Attention has been focussed during the past week upon the Liberty Loan the success of which is chief among the events worthy of note. The espionage bill has finally become law. The fight is now over food control with the President the probable victor.

The ship controversy progresses rapidly and the building of ships correspondingly slow.

The inefficiency of the Secretaries of War and Navy has become glaringly apparent.

The Government's program calls for 30,000 aeroplanes within a year.

Constantine of Greece abdicated in favor of his son. Spanish unrest grows. Kerensky is taking a firm hand in putting down Russian disorder.

German aeroplanes raided London and U-boat ravages again increased.

Business Endorses War Financing Plan

A preliminary count shows that every recommendation made in the war financing plan referendum submitted to the members of the Chamber of Commerce of the United States has been carried. Elliot H. Goodwin, secretary of the National Chamber, said the early vote announced here would be canvassed at a meeting of the Executive Committee next week.

The following recommendations were submitted to the members of the National Chamber. The vote on each is given. Each organization was allowed from one to ten votes according to its membership.

Approximately $400,000,000 of the amount raised by taxation the first year should be obtained, as a war measure, from increased individual income taxes, through certain increased super-taxes and decreased exemptions; 1235 in favor, 38 opposed.

Approximately $200,000,000 of the amount raised by taxation the first year should be obtained, as a war measure, by additions to the present excess-profits tax, with amendments of the law; 1080 in favor, 199 opposed.

The first-class postage rate, as a war measure, should be increased by 50%, to yield approximately $100,000,000 in the first year; 822 in favor; 340 opposed.

Stamp taxes should be imposed, as a war measure, to yield approximately $250,000,000 in the first year; 1192 in favor, 91 opposed.

Customs duties should be imposed, as a war-revenue measure, on articles to yield about $100,000,000 in the first year; 1318 in favor; 51 opposed.

Excise taxes should be imposed, as a war measure, upon certain articles of luxury and general use, which would yield about $500,000,000 in the first year; 1312 in favor, 16 opposed.

Retroactive taxes should not be imposed upon incomes and profits; 1232 in favor, 81 opposed.

The amount of exemption from the capital-stock tax should be decreased from $99,000 to $24,000; 1112 in favor, 138 opposed.

The committee approved the suggestion of the Administration that the tax exemption for married persons and heads of families should be reduced to $2000, and believed the exemption for single persons should be reduced to $1200. At present the super-tax does not apply until the income reaches $20,000 and beginning then with 1% it runs to 13% for the largest incomes. It was recommended that the war super-tax should begin with 1% on incomes in excess of $3000 and gradually rise to 40% for the largest incomes. The normal tax, which is paid by all income tax payers should remain as it now is, at 2%.

In regard to the excess-profits tax the committee declared some amendments were absolutely necessary to remove inequities that it believes will certainly arise from the present wording of the law. It recommended that local boards of referees should be appointed, to be composed of qualified accountants, to review appeals from preliminary assessments, reporting their findings with recommendation to the Secretary of the Treasury for his action. In order to lessen the number of appeals on trivial grounds, the cost of all appeals should be paid by the petitioners.

The members of the committee which made the recommendations in the war finance referendum indorsed by the commercial organizations are: Wallace D. Simmons, St. Louis, president of the Simmons Hardware Co., chairman; T. S. Adams, New Haven, professor of political economy at Yale; John V. Farwell, Chicago, president John V. Farrell Co.; Edward A. Filene, Boston, president of William Filene's Sons Co.; and P. W. Goebel, president of the Commercial National Bank, of Kansas City, Kan. Also John H. Gray, Minneapolis, of the University of Minnesota; Edward D. Hulbert, Chicago, president of the Merchants Loan and Trust Co.; Stoddard Jess, president of the First National Bank of Los Angeles; Hugh McK. Landon, Indianapolis; Robert F. Maddox, Atlanta, vice president of the American National Bank; Samuel McRoberts, vice president of the National City Bank of New York; and Oliver M. W. Sprague, Cambridge, Mass., of Harvard.

Motors at the Front

The number of motor vehicles in daily use for martial purposes is astounding, says a bulletin of the Society of Automotive Engineers. We are told that the density of traffic on Fifth Avenue is equaled, if not actually surpassed, by that which exists over a wide area on the French front. This traffic includes passenger cars, ambulances, quartermaster trucks, ammunition trucks, artillery tractors, special apparatus for engineer and signal corps, motor cycles, and half a dozen other types of vehicle in lesser number.

In addition, as many as a thousand airplanes are in action at a time. Meanwhile, the farm tractor is tilling the ground for the raising of crops, and submarine chasers are being run at express speed in search for submarines which are also propelled in part by internal-combustion

engines. "Tanks" are playing a most important rôle in offensive tactics. Thus on every hand is seen the indispensableness of automotive productions in the prosecution of the war.

Passenger cars make it possible for officers of the line to keep in much closer touch with operations and with each other than was formerly the case. The great physical strain of getting about has been reduced tremendously and their energies conserved for more efficient handling of the tactical problems.

The existence of vast fleets of quartermaster trucks insures that the soldiers will be better fed, more comfortably equipped and much more quickly transported than was possible with animal-drawn vehicles. The S. A. E. engineers have coöperated with the War Department in producing a set of specifications for military trucks which will result in a product superior to that which has been furnished to any of the foreign governments.

The great test of the automobile industry will come in connection with the manufacture of airplane engines. These require excessively close limits in manufacture, exceptionally good material, which must be accurately heat-treated, and a veritable army of inspectors to check over the various parts that will be used. The men that will carry this program forward will have to be recruited from the ranks of the automobile manufacturers. There are practically ten skilled mechanics in the flying service to one pilot, to say nothing of the army that will be required in the factories for turning out engines and planes, in the first instance, and at repair bases for keeping the equipment in shape.

German Trenches

Commenting upon a long and elaborate description of trenches in their uttermost refinement and the dugouts and underground quarters built by engineers, the *Infantry Journal* says of the German trenches:

"The numerous works described herein would seem at first glance too complicated and massive ever to be actually constructed, but they are the results of experience in modern trench warfare, and numerous examples of them exist on the western front today. By means of work of this character the Germans have been able to hold the conquered portions of France with the minimum of men. Their bombproof shelters and the arrangements for the comfort and health of their men have especially occupied the thought of commanders and engineers.

"In many instances their captured underground works have been found intact in spite of bombardments by the heaviest artillery. Some of these shelters have been excavated to a depth greater than 40 ft., with galleries 150 yd. long and 7 ft. high, completely lined with timber. On both sides of these galleries are large rooms, lined with timber, well ventilated by oblique shafts and furnished with field cots with wire springs.

"The timbering was so strong that in one case a 12-in. projectile which fell exactly over the top of the entrance did no damage except to crack a post. The exits are very numerous, and consist of six or seven stairways furnished with steel treads to avoid slipping, and several ramps with gentle slopes to permit of rapid exit in case of alarm. The shelters were heated with excellent stoves and lighted with electricity; the light and telephone wires ran along the walls, supported by glass insulators."

Insurance Instead of Pensions

Plans for issuing $4000 free Government insurance on the life of every American soldier and sailor during the war, to be paid to his beneficiaries without premiums in lieu of pension arrangements, will be taken up by the Council of National Defense. A report prepared by the Commerce Department urges that the insurance be provided through legislation before Americans are sent to France.

It offers a long list of arguments showing the advantage of working out a compensation system before American lives are lost in the war.

A Government insurance bureau would handle the whole subject, and there would be a provision by which officers and men desiring to do so could take out amounts higher than the $4000 free policy by paying premiums at peace rates.

Insurance companies, it is said, are ready to approve the scheme if assured the Government will not continue in the insurance business after the war. At the end of the war the Government, it is suggested, could turn over to insurance companies its premium war business, dropping the flat $4000 policies on all who leave the service, but continuing it on men who remain.

The plan would provide also insurance for partial or total disability. In case of death the insurance would be paid in installments, whose amount would be determined by a Government board.

Wake Up, America

"There is no France to hold the lines for America while she prepares for war. America must wake up." This was warning brought here by an American who has recently returned from England, where he has been on official business, for the past two years, says the *Boston News Bureau.*

"England, with her typical temperament, entered the war and then was 18 months getting ready to back up her declaration. France held the lines. Now after the campaign has been in force for months, England realizes that she must act and she is acting in just the same manner she should have done months ago. America seems to have the same temperamental self-satisfaction."

Herbert C. Hoover, appointed food administrator by President Wilson, has had his organization ready to take up its work for three weeks. He has built up an efficient machine for the handling of the great food problem—yet today this machine stands idle, a latent power, waiting while congressmen are bickering over details. The United States Shipping Board, organized before the war, has within the past two days placed the first material contracts for hulls.

State to Run Russian Mines

The provisional Russian Government has decided to establish a state coal monopoly, dating from July 14. At first the monopoly will be confined to the Donaetz Basin, in southern Russia, which is by far the most important coal district of the country, containing 1500 mines.

The purpose of the monopoly is to supply the internal market more equitably, prevent speculation and establish

prices which, while preventing undue profits, will enable the running of the mines without loss under the present high scale of wages. The Ministry of Trade says there will be a large economy in transport as a result of compulsory consumption on the spot of coal of low heating quality, leaving the better coal for distribution throughout the empire.

The government will allot $20,000,000 working capital for the monopoly. Profits will be used for the acquisition of machinery and for increasing otherwise the technical efficiency of the mines.

Our Diminishing Oil Supply

Unless the United States takes steps to develop new oil lands and takes control of fields in other parts of the world, the American supply will come under domination of some foreign power, Mark Requa, consulting engineer of the Bureau of Mines, told the Senate Lands Committee recently. He also predicted that unless immediate relief were found, an oil shortage within a year would paralyze commerce on the Pacific coast.

Mr. Requa said that when an attempt was made to consolidate independent oil companies in California with the Mexican Petroleum Co. to insure a greater supply for this country, interference by British interests prevented the deal.

The hearing was on Senator Walsh's bill for the leasing of coal and oil lands owned by the Government.

Red Cross Dividends

A number of corporations have announced special dividends for the benefit of the Red Cross, the idea being that stockholders receiving them will contribute the amount to the large fund that is being raised for Red Cross army purposes. The first corporation to take this action was the United States Steel Corporation, which announced a dividend of 1% on June 12, amounting to $5,083,025, in connection with which Judge Gary made the following statement:

The board of directors at a special meeting today declared an extra dividend of 1% on the common stock, payable July 28. This dividend was declared in response to the request of many stockholders to declare an extra dividend to enable them to contribute to the large fund which it is sought to secure for Red Cross army purposes, under the auspices of the American National Red Cross. The dividend checks will be sent to the stockholders with a statement of the circumstances which influenced the action of the board; and the disposition of the dividends will be left entirely with the stockholders in accordance with their interests and patriotic instincts.

Since the action of the United States Steel Corporation, the following mining and metallurgical companies have announced similar dividends as follows:

Kennecott	$0.20	$556,116
Nevada Consolidated	.15	299,919
Chino	.40	347,992
Utah Copper	.50	812,245
Butte and Superior	.40	116,079
Ray Consolidated	.20	315,436
Gulf States Steel	1.00	32,843
Trumbull Steel	1.00	27,500
Magma	.10	24,000
American Brass	1.00	150,000
American Smelting and Refining	1.00	609,980
International Nickel	.25	418,346
Bingham Mines	.25	35,025

The dividends so far announced will result in the addition of $8,828,506 to the Red Cross fund if all of the stockholders turn over their checks, which it is expected they will do.

Daniels' Bungling Halts U-Boat Chasers

According to a Washington dispatch, June 13, fewer than 25% of the submarine chasers which the Navy Department expected to rush in great numbers to the war zone will be completed on schedule time. Not more than 25 boats will be ready for service by August.

The trouble is that Secretary Daniels awarded contracts to persons who had no facilities for building ships of any kind, but took the proposals on a "shoestring plan," hoping to sublet the Government contract and make money. Promoters and contractors who agree to build anything, provided there is money in it, and one bookmaker, it now turns out, were among those to whom contracts were awarded, and they have not found it as easy as they imagined to sublet at a profit.

Inquiry at the Navy Department developed that Mr. Daniels awarded contracts to all who submitted bids below $50,000. With the bids it was only necessary to put up a nominal guarantee of $500 with the understanding that 10% of the contract price was to be put up in bond on award of the contract. It was the understanding that this amount was to be put up within 10 days after the award. But after 10 weeks the money has in many cases not been forthcoming, it is said. The prediction is made that many of these boats never will be built under present arrangements.

Empty the Pockets

James J. Phelan, of Hornblower & Weeks, says:

"When the war began, the issuing banks in Europe held about $2,400,000,000 gold, and such banks are now estimated to hold $3,400,000,000, an increase of $1,000,000,000, and this notwithstanding that the European countries have in addition shipped to the United States something over $1,000,000,000 of gold since the war began. A large part of this increase of $1,000,000,000 gold in the bank holdings, and a large part of the $1,000,000,000 which we have received is accounted for through emptying of the pockets of the people of Europe.

"It is estimated that the American carries in his pockets from $1,500,000,000 to $2,000,000,000 of paper money, that is—the per capita currency carried in the pockets of the people is estimated at from $15 to $20.

"Unless one is traveling, $1 to $5 would seem to be sufficient cash for any individual to carry on an average daily, and when traveling only that amount necessary to defray his trip expenses should be carried, and this only as a temporary excess.

"If we send through the length and breadth of the country the slogan: 'Empty your pocket. Deposit your money in the banks,' much of the fear that exists throughout the country would be relieved to the extent that deposits would increase in the proportion that pockets would be emptied."

Our Balance of Trade

The Department of Commerce issues the following: Exports from the United States for the year ending with April, 1917, exceeded $6,000,000,000, the excess over imports during the same period being $3,500,000,000. The excess of gold imports over gold exports during the 10 months ending April, 1917, amounted to $666,000,000.

Editorials

The Government and the Metals

The Governments—both our own and those of our allies—are going to need large quantities of metals of all kinds. Uncertainty respecting the quantities needed, the terms of the supply and delay in making the arrangements has been naturally an unsettling influence in the markets. The Advisory Council of National Defense assigned one of its members to the attention of raw materials. That member, who has many things other than metals to consider, appointed assisting committees among the producers in the several industries. Thus there is a copper committee, a lead committee, and so on. These committees have been in conference with the Government. Terms have been discussed, but no decisions have been reached. There is no use in mincing words as to where the responsibility rests.

It is with Secretary Baker and Secretary Daniels.

Nor is there any reason for haggling about the question that is at issue.

It is cheeseparing policy and misunderstanding of the conditions of business and economics.

Let the copper producers say that they will supply all the copper required by the Government at 10 or 15c. under the market price, let the lead and zinc producers make a similar offer, all arrangements would be quickly made and Mr. Baker and Mr. Daniels would promptly cause themselves to be heralded as zealous officials who had saved the country millions of dollars.

But in fact there would be no such saving to the country. If the Government takes out of the market a large part of the supply at an arbitrary price lower than the natural price, it is manifest that the supply remaining free is going to be bid up by private consumers to a price higher than the natural price. Consequently, although the books of the Government may reflect a fine bargain, the price for other consumption is enhanced, and what the people save in one way they lose in another.

That such would be the effect is neither hypothetical nor idly speculative. We have during the last year had precisely analogous examples of what will happen. In copper our normal transactions average about 50 million pounds per week and the relatively small fluctuations in demand and supply above and below that figure determine the natural market price. Last fall the Allied Governments in a series of purchases removed from the market about one-third of the expected supply in the first half of 1917, contracting for the bulk of it at about 25c. per lb. The market being thus denuded of supplies, rose sharply to 30c. and higher and has been maintained at such levels on transactions not averaging more than 10 million pounds per week, we judge, during the eight months since the large special transactions were made. This condition was reflected in the actual averages received by copper producers in 1916, being materially less than the quotational average. During the first half of 1917 the difference will be larger.

Similarly in lead. A large proportion of our production, perhaps as much as 75%, is contracted for consumption on the basis of average prices—partly on the average quoted by the American Smelting and Refining Co., partly on the average of the *Engineering and Mining Journal.* These averages differ, for the former reflect only a single business while the latter reflect the whole market, although in the long run they come to about the same thing. However, that is not the point in the present argument, which is that recently the owners of uncontracted lead were able to get 12c. per lb. for it, while the A. S. & R. Co. was supplying lead on its contracts at 11c., only *because* such contracts were in existence and to such an extent.

The supply of copper available in the free market is also diminished by the considerable quantities that are supplied to consumers at average price, which is a subtraction in addition to what is taken away by the foreign governments at a fixed price. In so far as the average-price contracts are concerned, the situation in copper is the same as in lead, except that they are not so extensive. However, the effect on the market is the same whether a large part of the supply be removed by a contract at a fixed price or by a contract at a varying price, but in the former the difference between the contract price and the price for uncontracted supplies may be greater.

These explanations of things that have happened, and are now happening, are simply another way of saying that the law of supply and demand prevails as it always has and always will. Mr. Baker and Mr. Daniels may put feathers in their caps, but they will be nothing but feathers of political claptrap. In the long run the Government and the people cannot do any better than purchase their supplies at the market price. If the Government can so organize its buying as to eliminate competition among itself and the allies, indeed eliminate competition among its own departments, thus removing appearances of more demand than there is, it will have done about all that economically it ought to. Yet even as late as last week we saw the Frankford Arsenal on its own hook asking for tenders of lead while Mr. Baruch was negotiating with the Lead Committee for a large supply for the Government. Why such a thing should be permitted is to be accounted for only by mental chaos in Washington.

In our considerations heretofore in this article, we have assumed that it was only a question of buying by the American Government for its own purposes and buying by domestic consumers. The more cheaply the Government buys the more dearly will the other consumers have to pay. But there are practically other factors of major importance. What of the needs of our allies? Will Mr. Baker and Mr. Daniels buy cheaply for our own army and navy and leave it to our allies to buy in competition with domestic consumers? Or will they buy for our allies on the same terms as for ourselves and cause domestic consumers to pay even higher prices? How then are

our allies going to distinguish between military consumption and commercial consumption? Are we going to provide Great Britain with cheap lead for her export trade while American manufacturers competing in the same markets can only have dear lead?

Washington meets economic arguments by saying that if necessary it will establish maximum prices. Suppose it does and there is not enough lead for everybody, who is going to say what consumers shall have it and what shall not? The trouble is that the lead supply is insufficient. As to copper supply there is not such an acuteness. Let the markets alone and natural factors will say who shall have the supplies and who shall not; that is, they will go to the highest bidders, and the time will come when unnecessary consumption will have strangled itself and when increasing production will have ameliorated the situation on the other hand. The history of zinc since the beginning of 1915 affords a perfect picture of the operation of the natural law. The supply of zinc has now become plentiful, and in that industry there is no such excitement as there is in lead and copper about what the Government is going to do.

The Mastery of the Air

Now that the United States is definitely in the war and is to be considered an essential unit in it, the brains of the country are working on the problem of how best to achieve a successful outcome. What we need is the cheapest solution; the cheapest in lives, in time and in money. The subject of air navigation received serious consideration during the early period of the war, but has not been so strongly in the public eye of late. It would be a good thing to bring attention back to it. The Zeppelins, it is now conceded, have proved a costly failure. They are so big as to be easy marks for anti-aircraft guns and entirely too slow to get away from fast airplanes. They can no longer be considered a factor. The mastery of the air, which they were expected to accomplish, has not been secured by them.

The advantages that will accrue to the side that secures the uncontested control of the air are almost unlimited. It is well known that the airplane acts as the eyes of the artillery, directs its shots, reports their effects and corrects the aim of guns that have missed. It is not so well known, however, what other work the airplane is capable of doing if it can overcome resistance of its own kind. On the Western front it is well known that the Germans have been entrenched for so long that they have had time to build complicated trench systems and bombproof cellars that cannot be reached by the heaviest and strongest artillery fire. To capture these requires a large expenditure of lives that can ill be spared. Airplanes can, however, when in control of the air, strike far back of these lines of trenches, destroy communications, break up infantry movements, destroy industrial plants, and, not the least important factor, attack and uproot the submarine bases on the coast. In fact, only a little reflection is necessary to show that by means of complete mastery of the air it will be possible to inflict such damage upon the German enemy that he cannot continue to fight.

It has been well and truly said that one capable aviator is of more value than a regiment of infantry. It seems thoroughly practicable, reasonable, and well within the bounds of possibility for America to throw such an enormous excess of strength upon the Allies' side that the mastery of the air can be effectively accomplished. Only consider the enormous cost in lives of attacking these strong German lines of trenches on the ground level, and then consider the great saving of life that would be accomplished by having a much more moderate fleet of airplanes that could reach behind the enemy's lines, destroy his communications, wreck his munitions factories and crops and obliterate his submarine bases. It is so much easier to go over the trenches than to attempt to go through them. So much cheaper—cheaper in lives, in time and in money, the wastage of which we must strive to reduce. The public should insist upon a strong aviation policy by this Government. The policy should be one of overwhelming air control, so powerful that no German aviator would be able to practice his art at any point. With the mastery of the air accomplished, the end of the war will have been brought clearly into sight.

An American Silver Market

The high cost of shipping, including war risk, to London is bringing about, slowly but steadily, a change in the movement of silver from this country. All efforts previously made to establish a direct market for silver with the countries in the far East—which are the largest buyers of this precious metal—have proved unsuccessful on account of the hold which the English bankers and silver brokers had on the market. However, economic conditions are stronger than traditions.

At present, standard silver in London is quoted at 39-1/16d., which price is equivalent at the rate of sight draft of 4.755 to 83.583c., while the New York quotation is 77c. The reason for this large discrepancy is principally the high cost of insurance, even the Government rate on war risk being 5%. It stands to reason that China and other Eastern silver buyers fare much better in getting their silver shipped from our Pacific Coast than in drawing the silver from London—the war-risk rate across the Northern Pacific being only about ½%.

It is to be hoped that this market, once established, will not be lost after the war is over and that this country will be in a position to dispose of its large silver production direct in the Eastern markets.

Misfits in the Cabinet

We are said to be profiting by English mistakes. The British sent us a mission especially that we might. This is a good thing. Let us begin at the top. A common error in England at the beginning of the war was the occupancy of high positions by men totally unfit. It has long been apparent and becomes increasingly so every day that the Secretary of War and the Secretary of the Navy are square pegs in round holes. We feel pretty sure that they are square, and we feel sure also that they do not fit the holes.

Perhaps they are still new to their work, although Mr. Daniels has been four years at his job. Some men are not as adaptable as others. Perhaps their errors are simple mistakes and they will not make them again. But there are so many different varieties of mistakes possible that a man with a tendency to err can make them all his life and never make the same one twice.

Perhaps accepting bids for "chasers" from "shoestring" contractors was, after all, nothing but a mistake on the part of Mr. Daniels. Perhaps Mr. Baker's bungling about the plans for the cantonments, which is going to delay the assembling of the National Army for several months, is excusable. But in a crisis like the present we have to think how many mistakes may be allowed to officials in high places before they ought to give way to other men who have a better batting average. Yet we do not want to minimize much excellent work that both Mr. Daniels and Mr. Baker have done.

Labor Troubles

Strikes have been threatened among some of the copper mines in Arizona, but no serious difficulty has occurred there. This week labor troubles developed in such widely separated regions as Kennecott, Alaska and Butte, Mont., that at the latter place being the more serious. It appears to have been fomented by the I. W. W. and socialist element, assisted by Sinn Feiners who were opposed to the war with Germany, while there is a suspicion that German agents may be at the bottom of it all. The disturbing elements in Butte constitute a very small minority, but comprise the riotious kind of men, and they have succeeded in frightening many of the law-abiding and well-satisfied miners away from their work, although they would prefer to stick to it. This is what makes the situation at Butte really serious.

That there should be labor troubles at Butte or in any of the copper-mining districts with the present scale of wages, which are higher than ever enjoyed previously, corresponding by sliding scale with the high price for copper, is nothing less than preposterous. The circular calling upon the men to join in the strike reads more like the vaporings of the Council of Workmen's and Soldier's Delegates in Petrograd than anything to be expected in the Great Republic in time of war. There ought to be short and sharp disposition of these misguided and unpatriotic men who threaten to deprive the nation of copper at a time when every pound that can be produced is sorely needed.

Total amount of subscriptions to Belgian Kiddies, Ltd., up to date, is $97,565.

BY THE WAY

MARY'S INVESTMENT.

Mary had a little bond,
She bought it for a dollar,*
And every coupon she tore off
Just made the Germans holler.
*Per week.—*The Wall Street Journal.*

A Joplin engineer, somewhat irritated by the reference to "Joplinese," has responded: "That Michigan engineer who was down here recently and wrote, objecting to the localisms of this districts, might well remember the old adage about the stone-throwing proclivities of people who live in glass dwellings. 'Mineral' up there means copper concentrate, and they call the ore 'rock.' I do not know what word they use for waste, but it is just as well to bear in mind that all the localisms are not in the Joplin district."

It has been said that the soldier in war time becomes a good deal of a fatalist but through all the sanguinary days on the European battle line the French soldier has kept his sense of humor, says the *Infantry Journal* The "Poilu's Litany," republished by it, has much food for thought for others than fatalists:

Of two things one is certain—either you're mobilized or you're not mobilized. If you're not mobilized there is no need to worry; if you are mobilized, of two things one is certain—either you're behind the lines or you're on the front.

If you're behind the lines there is no need to worry; if you're on the front, of two things one is certain—either you're resting in a safe place or you're exposed to danger.

If you're resting in a safe place there is no need to worry; if you're exposed to danger, of two things one is certain—either you're wounded or you're not wounded.

If you're not wounded there is no need to worry; if you are wounded, of two things one is certain—either you're wounded seriously or you're wounded slightly.

If you're wounded slightly there is no need to worry; if you're wounded seriously, of two things one is certain—either you recover or you die.

If you recover there is no need to worry; if you die you can't worry.

The "exact spot" where gold was discovered in California in 1848 by Marshall is now marked by a cedar post on which is mounted an American flag. There has been so much discussion and disagreement as to the particular spot, near the town of Coloma, at which Marshall got the gold that recently five old-timers got together and racked their memories as to what "Uncle Jimmie" told them about it and finally they decided to dig a hole and sink a cedar post in the hole to mark the spot. And of course it is not the same spot which has long been marked by a monument of rocks from which a flag has long been waving. No sir! It is several yards "this side of the rock pile;" "Uncle Jimmie" told these old-timers, and they should know if anyone does. And that was the spot at which gold was first discovered in California. Never mind about that story of the little boy who really discovered the gold and gave it to Marshall and showed him where he found it and did not even get his nugget back. Never mind about that ancient historian, Richard Henry Dana, who spent two years before the mast and came round the Horn and told about the Indians bringing gold to the coast of southern California way back in 1842, and all that talk about gold being shipped to Boston from California before Marshall hit the trail. What did they know about gold in Boston. And what right had the Indians to discover gold, especially in southern California. This ancient history doesn't go—not around Coloma. Everybody knows better. Of course, everybody was not sure that the rock pile and the flag marked the exact spot. But the controversy is settled now by the planting of the cedar post by the old-timers who knew "Uncle Jimmie."

Personals

Rush M. Hess has been appointed manager of the United Mines Co. of Arizona at Bouse, Yuma County.

E. Gybbon Spilsbury sailed on June 5, for Central America and expects to be absent until the middle of July.

Chester Atkinson has been appointed superintendent of the smeltery of the Cerro de Pasco Co., at La Fundicion, Peru.

Philip N. Moore, of St. Louis, President of the American Institute of Mining Engineers, paid a visit to New York City last week.

Dr. John H. Banks has returned to New York from Ontario where he has been examining properties in the Boston Creek district.

Robert J. Goodwin has resigned his position with the Boss Gold Mining Co., Goodsprings, Nev., and will enter the Engineer Corps of the U. S. Army.

O. E. Jaeger has resigned as superintendent of the Cerro de Pasco smeltery, at La Fundicion, Peru. He will offer his services to the British army.

V. H. Emery, superintendent of the Hollinger Consolidated, Porcupine, has received a commission in the Canadian Engineering Corps for service overseas.

Douglas A. Mutch, manager of the Hudson Bay Mines, Ltd., at Cobalt, has been appointed Consulting Engineer for the Dome Lake Mining & Milling Co., South Porcupine.

H. G. Dalton, of Cleveland, Ohio, is chairman of the sub-committee on pig iron, iron ore and transportation of the Advisory Commission of the Council of National Defense.

John N. Allen has been appointed manager of the mining and transportation departments of the Brier Hill Steel Co., Youngstown, Ohio. He succeeded John E. Perry.

John R. Morron, president of the Atlas Portland Cement Co., is chairman of the sub-committee on cement of the Advisory Commission of the Council of National Defense.

Edmund Putnam, formerly of Parral, Mex., is developing for J. E. Baum and associates, of Philadelphia, a bauxite deposit near Elizabethton, Carter County, Tennessee.

Louis G. Gerhardt, together with E. Harvy Miller, M. H. Smith, R. G. Hinman and Fred Sutton, has been recommended for a fellowship in metallurgy at the University of Utah.

Arthur A. Cole, president of the Canadian Mining Institute, is traveling through the Canadian West securing industrial returns for the Advisory Council for Industrial and Scientific Research.

Gelasio Caetani, first lieutenant in the First Regiment of Italian Engineers, lately returned to one of the Italian fronts after four or five months' service with the French Army in Servia.

F. E. Lathe, head assayer of the Granby company's smelter at Grand Forks, has resigned to join the staff of the Chile Exploration Co. He was with the Granby company for nine years.

J. S. Fraser, superintendent of blast furnaces for the Pittsburgh Steel Co., has been promoted to superintendent of furnaces and steel works. H. R. Shick, assistant furnace superintendent, has been appointed blast furnace superintendent.

Raymond B. Ladoo, of the Low Moor Iron Co., Virginia, has been temporarily transferred to the company's coal properties, at Kay Moor, W. Va., where he is superintending the building of a battery of beehive coke ovens.

V. F. Marsters has opened an office at 316 Rialto Building, Kansas City, Mo., as consulting engineer in geological work, especially in connection with the petroleum fields of the Southwest. He will be associated with Chas. N. Gould, who has also an office at 1218 Colcord Building, Oklahoma City, Oklahoma.

The Consolidated Mining and Smelting Co. of Canada, has so increased its operations that it has become necessary to divide the responsibilities. According to the company's recently issued annual report, the staff officers now are: R. H. Stewart, consulting engineer; S. G. Blaylock, assistant general manager; E. H. Hamilton, metallurgical manager; W. M. Archibald, manager of mines; T. W. Bingay, comptroller; James Buchanan, superintendent of smeltery; J. F. Miller, superintendent of refinery; M. E. Purcell, superintendent of Centre Star group of mines; E. G. Montgomery, assistant superintendent of Centre Star group of mines; F. S. Peters, superintendent of Le Roi mines; J. K. Cram, superintendent Sullivan and St. Eugene mines; Frederick Chapman, engineer in charge of construction of the smeltery. A selling organization for the products of the company was established last year, W. S. Rugh being appointed sales agent for Canada west of the Province of Quebec, and Thomas Robertson & Co., Ltd., remaining selling agents for the Eastern territory.

The Chile Exploration Co. is organized as follows, according to the annual report of the Chile Copper Co.: President, Daniel Guggenheim; vice-presidents, Albert C. Burrage, Harry F. Guggenheim, Murry Guggenheim; secretary, C. K. Lipman, assistant secretary, W. E. Bennett; treasurer, Leopold Fredrick; comptroller, M. M. Van Keuren; general auditor, O. L. Myers; purchasing agent, G. G. Thomson; employment agent, Edward Savage. The directors are: Albert C. Burrage, Albert C. Burrage, Jr., Russell Burrage, Isaac Guggenheim, Daniel Guggenheim, Murry Guggenheim, S. R. Guggenheim, Edmond A. Guggenheim, Harry F. Guggenheim, Fred Hellmann, C. K. Lipman, William Loeb, Jr., John K. MacGowan, William A. McLaren, Willard S. Morse, C. L. Myers, William C. Potter, E. A. Cappelen Smith, John N. Steele and H. R. Wagner. Executive committee: Harry F. Guggenheim, chairman; Albert C. Burrage, William C. Potter, Edmond A. Guggenheim. Consulting mining engineer, Fred Hellmann; consulting milling engineer, H. A. Guess; consulting electrical engineer, P. H. Thomas; consulting metallurgical engineer, E. A. Cappelen Smith; construction engineer, S. B. Williamson; consulting power engineer Fred Sargent (Sargent & Lundy). Officials in Chile: General manager, H. C. Bellinger; general representative at Antofagasta, W. E. Pulliam; general representative at Valparaiso, H. R. Wagner; manager welfare department, B. T. Colley.

Obituary

Alois Von Isakovics, proprietor of the Synfleur Scientific Laboratories, died at his home in Monticello, N. Y., on June 5.

William Smith Horry died on April 14, 1917. He was known principally in connection with the development of calcium carbide furnaces, at Niagara Falls and other places.

Edward R. Taylor died at his home in Penn Yan, N. Y., on May 28. He was best known for his electrical carbon bisulfide furnace, a description of which he contributed to the first meeting of the American Electrochemical Society.

David E. Park died in Pittsburgh, May 30, aged 68 years. He was born and educated in that city. His father, James Park, was founder of Park Brother & Co., Ltd., crucible steel manufacturers, later known as the Black Diamond Steel Co. Mr. Park was active in the formation of the Crucible Steel Co. of America, which took over the Black Diamond Steel Co. and at that time he retired from active business.

Delorme D. Cairnes, of the Canadian Geological Survey, died recently in his 38th year. He was graduated in 1905 from Queens University, Kingston, Ont., and subsequently took post-graduate work at the Royal School of Mines, Saxony, and at Yale University from which he received the degree of Doctor of Philosophy in 1910. He joined the staff of the Geological Survey in 1905, his field of work being chiefly in Northern British Columbia and the Yukon Territory—where his investigations did much to promote the mining industry. Mr. Cairnes was connected with many technical and scientific organizations including the "Freiberg Geologische Gesellschaft," the Geological Society of America, American Association of Science and Canadian Mining Institute and was the author of many valuable papers contributed to these bodies in addition to his official reports.

Societies

University of Wisconsin, Madison, Wis., will hold its nineteenth annual Summer Session of the College of Engineering during the six-weeks period beginning June 25, 1917. Special courses will be given in Chemistry, Electrical, Steam, and Hydraulic Engineering, Gas Engines, Machine Design, Mechanical Drawing, Mechanics, Shop Work, and Surveying. All courses given in the University Summer Session are open to engineering students. Special courses have been arranged for engineering, manual arts, and vocational teachers.

American Institute of Mining Engineers, Montana Section, held one of its informal meetings on the evening of May 21, 1917, at the Silver Bow Club, Butte, Mont. Forty-seven members and ten guests were present. The purpose of the meeting was to welcome President P. N. Moore of the Institute, and to discuss the general topic "How Can the Institute Best Serve the Country in the Present Crisis?" After the dinner, F. W. Bacorn, acting as toastmaster and chairman, made a few remarks on the purpose of the meeting and introduced Col. Dan. J. Donohue who ably discussed the problems of the army. The navy was reviewed in an interesting way by Eugene Carroll. Discussion followed by E. H. Wilson and B. H. Dunshee. President Moore then spoke on the relation of the Institute to the Council of National Defense. He paid high tribute to H. C. Hoover and his work in Belgium; and closed with an interesting review of the internal problems of the Institute. Discussion followed by J. L. Bruce, C. W. Goodale, James Hyde, Mr. Houser of St. Louis, and Oscar Rohn. After adjournment an informal social hour was enjoyed by all present. On May 22 a luncheon was served by the Anaconda members of the A. I. M. E. at the Anaconda Country Club, in honor of President Moore. Covers were laid for fifty-six. After the repast C. D. Demond called the members to order in the reception hall and with a few well-chosen words introduced the guest of honor. President Moore's talk was filled with anecdotes, advice and information and was appreciated greatly by the young men present.

New Patents

United States patent specifications listed below may be obtained from "The Engineering and Mining Journal" at 25c. each. British patents are supplied at 40c. each.

Aluminum—Method of Processing Aluminum Skimmings, Screenings, Slags or Analogous Materials. Paul R. Hersman, Milwaukee, Wis., assignor, by mesne assignments, to William F. Jobbins, Incorporated, Aurora, Ill. (U. S. No. 1,229,611; June 12, 1917.)

Copper—Process for Extracting Copper from its Ores. Henry Byron Slater, Los Angeles, Calif. (U. S. No. 1,230,078; June 12, 1917.)

Dredging—Placer-Dredge Tumbler. Wesley Groff Nichols, Chicago Heights, Ill., assignor to American Manganese Steel Company, Chicago, Ill. (U. S. No. 1,229,313; June 12, 1917.)

Drilling—Method of Manufacturing Drill-Bits. Samuel V. Rawlings, Calumet, Mich. (U. S. No. 1,229,790; June 12, 1917.)

Furnace Fire-Bridge. James Hollingsworth Clegg, Wallasey, England. (U. S. No. 1,229,887; June 12, 1917.)

Ingot-Mold. Andrew Laitsch, Pittsburgh, Penn. (U. S. No. 1,229,295; June 12, 1917.)

Metal-Melting Furnace. Dwight S. Marfield, Cincinnati, Ohio, assignor to The Buckeye Products Company, Cincinnati, Ohio. (U. S. No. 1,229,494; June 12, 1917.)

Mining Apparatus for protection while excavating and transferring material. Trimble de Roode, New York, N. Y. (U. S. No. 1,229,418; June 12, 1917.)

Mine-Roof Support—Means for Supporting the Roofs of Mine-Entries. James J. Roby, Cleveland, Ohio. (U. S. No. 1,229,323; June 12, 1917.)

Ore Concentrator or Separator. William H. Monroe, Ashland, Ala., assignor of one-fourth to G. A. Mattison and one-fourth to A. B. Conklin, Ashland, Ala. (U. S. No. 1,230,081; June 12, 1917.)

Silica—Process for Treating Silica. Israel Rosenblum, Swampscott, Mass. (U. S. No. 1,229,324; June 12, 1917.)

Smelting Fume—Condenser for Smeltery Fumes. Gustav P. Luebke, Chatham, Ill. (U. S. No. 1,229,629; June 12, 1917.)

Smelting Fume — Fume-Disseminator. Leonidas D. West, Denver, Colo. (U. S. No. 1,229,363; June 12, 1917.)

Specific Gravity—Scale for Determining Specific Gravities. Max Munzner, Arlington, N. J., assignor to The Torsion Balance Company, New York, N. Y. (U. S. No. 1,229,641; June 12, 1917.)

Surveying—Plumb-Bob Apparatus. Jonathan Perkins, San Diego, Calif. (U. S. No. 1,230,074; June 12, 1917.)

Editorial Correspondence

SAN FRANCISCO—June 14

Petroleum-Engineers Examination will be held by the California Civil Service Commission, probably, early in July. No written tests or theses will be called for, but an oral examination before a special board of examiners will be held. Engineering education and some knowledge and experience in oil-field work will entitle an applicant to a try for the examination. The application must reach the Civil Service Commission at San Francisco, Sacramento or Los Angeles before June 30, 1917. Petroleum engineering, particularly in California, offers an extremely promising field during the next few years to young men who will undertake to prepare themselves for the work. The salaries, which will be paid by the California State Mining Bureau, for men selected from the successful applicants in the coming examination will range from $1500 to $2400 a year.

First-Aid and Mine-Rescue Contests will not be held in California in 1917. The contests were previously held under the direction of the California Metal Producers Association, in connection with the U. S. Bureau of Mines. The Bureau of Mines has recommended that nothing of this character be done during the year that will in any way interfere with the maximum production of metals so necessary in the present war emergency. Insofar as it is possible the first-aid and mine-rescue teams, in their individual efforts and also under the direction of the Bureau of Mines rescue car, will confine themselves to Sundays and holidays and as nearly as possible to such hours when the men are off shift. Edwin Higgins, who is safety engineer for a number of mines whose operators are members of the California Metal Producers Association, will coöperate with the bureau and the association in the matter of avoiding any interference with the work of the men in the mines.

Alien Claimants of Compensation have not been denied by the California Industrial Accident Commission. Information from other states as well as from the Federal compensation commission is that such discrimination has not taken place and none is contemplated when considering such claims. The California commission will not raise the question and expresses the hope that it will not be raised. It is believed that American citizens will approve the assertion that public policy requires recognition of the rights to compensation of thousands of alien workers, born in Germany, who are worthy residents of California. The situation in which these workers find themselves cannot be improved by harsh measures. The commissioners are advised by the Department of Justice at Washington that a bill has been drafted, to be introduced in Congress, having for its object the regulation of all trading with alien enemies, including the right to receive workmen's compensation. The question is essentially one for Federal control.

BUTTE—June 14

Labor Troubles in Butte are once more to the fore. The I. W. W. element which just three years ago started the riots that resulted in breaking up the Butte Miners' Union and caused the sending to Butte of the Montana National Guard, has become active again. The I. W. W. and socialist elements, combining with the Finlanders and the radical Irish who were opposed to the war with Germany, got together recently and issued a circular calling upon the miners to organize and make certain demands as outlined in these columns last week. In response to this circular, the miners employed at the Elm Orlu Mining Co. quit work. This was but a single mine. On the day following about 10% of all the miners employed by the Anaconda company quit work and assisted in organizing what is called the "Metal Mine Workers' Union." It started with a membership of about 400 out of a total of 20,000 men in the Butte mines. As soon as this new organization was formed it called a strike. It did this before formulating any grievances or presenting any demands to the companies. It sought to shut down the mines but in this its efforts met with failure. The companies on the afternoon that the new organization was formed issued the following statement in reply: "The attack upon Butte's industries is being engineered in the main by the same element which was responsible for Butte's serious trouble in 1914. It is well known that recently there has been a large influx into Butte of I. W. W. men and other unpatriotic and seditious persons whose one aim has been to paralyze our industries, and particularly those upon which the government is dependent for its arms and ammunition. This element forms but a small proportion of our population but is attempting to pursue its usual vicious methods of intimidation and violence. Their attempts to riot on registration day plainly indicates their motives. Neither this element nor any organization made or controlled by it will receive any consideration or recognition by the mine operators of Butte. No grievance of the workers in the Butte mines has been brought to the attention of the operators and we believe that none exists. The wages paid in Butte are on the average the highest paid anywhere in the world. In a few of the Southern districts where the labor is classified, a small proportion of those employed receive higher wages than the Butte underground wages, but the average is much lower. The working conditions in Butte are better than the average, and compare favorably with those of any other camp. The same may be said of living conditions, which are much superior to those of many of the camps for which the extravagant wage claims are made. This disturbing element, by threats to destroy the property, fire the mines and do violence to employees who wish to work, has caused a number of men to stay at home. This defection so far has not been serious and cannot be, as the mine operators and the people of Butte generally, are determined not to permit a repetition of our former experience. The mine operators intend to give their employees the opportunity which the great bulk of them desire, to continue at their work. Every possible measure of protection will be given to the employees by the operators and by governmental authorities, and there should be no anxiety or fear on their part of injury while going to or coming from or attending their work. The Butte mines will continue to be operated. The miners of Butte will not permit a comparatively small band of cowardly agitators and nonworkers to deprive them of their livelihood and drive them from their homes, but such protection as they require will be furnished them." The statement is signed by the Anaconda, Butte & Superior, East Butte, Elm Orlu, Tuolumne, and the Davis-Daly company. In accordance with the promises made the mine operators secured the assistance and coöperation of the city, county, state and national authorities and the last placed over 1000 regular troops in Butte in addition to a large force of special deputy sheriffs and police who were put on the forces.

(By telegraph—June 20)

Strike Situation More Serious in Butte and mines are all practically closed down. Strikers claim 12,000 men are out. Mining companies have abandoned all shifts but day shift at mines, not being able to get enough men to work more, and for further reason that men who wish to work will not have to be out at night and run risk of assault by strikers. Striking electricians, who went out for increase of $1 per day from Montana Power Co., have taken up fight of mine strikers and made demand of mining companies that all demands of miners be granted and that mining companies use their influence with Montana Power Co. to grant demands of electricians. These impudent demands instantly refused, and electricians then called out all their men working for mining companies, hoping to force general shutdown and cripple light and power service in city and on railroads. Power company says it will be able to continue service for some time with help of other employees. Central Labor Council tonight endorsed demands of electricians but refused to recognize new union of miners because latter is not organized under any general labor body. There is talk of possibility of martial law again being declared in Butte. Several companies of soldiers are camped in Butte awaiting orders. Authorities and mining companies are finding evidence that present labor trouble is part of general pro-German conspiracy to hamper copper and zinc production. Leaders of strike movement appear to be abundantly supplied with funds.

DENVER—June 14

Curtailment of Development in advance of stoping, is being adopted at a number of mines and may affect the continuance of regular output. Enlistment of miners for war duty has brought about such a shortage of labor that the remaining men are needed in ore extraction. In line with similar action taken in other Western states, the executive committee of the Colorado Metal Mining Association has passed a resolution requesting the Government to exempt from military service all employees of the metal-mining and metallurgical industries. The belief is expressed that Colorado's mines could maintain normal metal productions for perhaps one year.

Draining of Sneffles District by the new Camp Bird tunnel is a possibility, judging by the results of the Revenue tunnel in the past. This latter tunnel, driven at an elevation of 10,700 ft., not only drained the workings on the Virginius vein, but a part of Marshall Basin on the Telluride side. The Camp Bird tunnel at an elevation of 9300 ft. will probably drain the workings of the Atlas, Hidden Treasure, Pedro and Revenue. Ouray mining men point out that if the draining effect extends into Savage Basin, the Tomboy company would have to obtain milling water elsewhere, and the simplest solution of the problem would be the construction of a milling plant below the portal of the Revenue tunnel in Canyon Creek, in Ouray County, as the Montana workings of the Tomboy are already connected with the Revenue tunnel. Such a possibility is looked upon with great favor by Ouray, because at present considerable ore is mined by the Tomboy and Smuggler-Union companies on the Ouray side and milled on the Telluride side, Telluride and San Miguel County thereby receiving the benefit.

Isolated Districts in Colorado are showing an activity in mining, as summer advances, that has not been experienced in this state for many years. Silver Plume, long almost deserted, is again intensely active and every house is full. In Boulder County, new discoveries in outlying districts are frequent occurrences. Custer County, once made famous by the Bassick mine, but long forgotten, is being rejuvenated by the work of companies and many small sets of lessees. In Gunnison County, rich but almost inaccessible districts, containing ore deposits of lead, zinc, molybdenum, manganese and other minerals, are taking on new life as the snow line retreats, and zinc and molybdenum ores are being produced. In remote sections of Eagle County, gold prospects are being opened, and on Brush Creek, silver-vanadium deposits will be worked this summer; east of Buena Vista, interest in prospects in the Cottonwood district, idle for years, is again being shown. Considerable work will be done at Frisco in Summit County, and Kokomo, which "came back" last year, will be a large shipper this season. To even a greater extent are the regular producing districts showing increased activity, a record production this year being prevented only by the lateness of the season and the great scarcity of labor.

SALT LAKE CITY—June 14

Strike at Tooele Plant of International Smelting Co. began on June 13. Smeltermen and common laborers, numbering between 800 and 900, went on strike for a flat increase of 50c. a day in wages. The strikers returned to work after stating their grievance and promised to remain at work until June 16, pending settlement. However, work was stopped on June 14. The strike does not affect machinists, of whom there are about 100. The smelting company offers a wage increase of 15, 20 and 25c. a day according to the class of labor involved—a greater increase not being considered possible at present, the scale being dependent on the price of metals. The strike has not been accompanied by disorder of any kind.

Haulage in Little Cottonwood is annoying producers in the Alta section who are anxious to bring an increased tonnage to the market during the shipping season now beginning. Complaint has been made against the Salt Lake & Alta railroad as to equipment, it being stated that the rails are not heavy enough to transport the desired tonnage, and there is talk of installing tractors. The ores from this cañon are hauled by wagon or sled, according to the season, except in the case of the Michigan-Utah, which has an aerial tramway for part of the distance, to Wasatch, the terminus of the Salt Lake & Alta railroad, which carries them from that point to Murray in Salt Lake valley. There is a narrow-gage road in process of completion from Wasatch to Alta.

WALLACE, IDAHO—June 14

Acquisition of Sweeny mill, owned by the Federal company, has been announced by F. W. Bradley, president of the Bunker Hill & Sullivan company, and title will soon be transferred to that company. The announcement recalls the terms under which this transfer will be brought about. The Sweeny mill is near the new Bunker Hill smeltery and treats the ore from the Last Chance mine. A few years ago the Bunker Hill & Sullivan and the Federal company were lined up for a big law suit over conflicting claims to Last Chance ground, which is situated in the heart of the Bunker Hill holdings. The workings of the Last Chance are above the town of Wardner, the lowest level being probably 1000 ft. above the Kellogg tunnel of the Bunker Hill. The litigation promised to be another of those long drawn-out cases, for the ground was valuable, as proved by the long and profitable production of the upper workings, making the lower ground which is accessible to the Bunker Hill a prize that fully justified the great legal battle that was being staged. But the battle was never fought. After devoting much time and money to the preparation of maps, models and other forms of evidence to present in support of their respective claims, a settlement was effected out of court. Under the terms of the settlement the Federal company received 38,000 shares of stock in the Bunker Hill & Sullivan company, which it still holds, and agreed to confine its operations in the Last Chance mine to the ground above the lowest level, and whenever, for a period of six months, the Last Chance failed to show a profit, then the entire property would be transferred to the Bunker Hill & Sullivan company, including the Sweeny mill. For some time it has been known that the upper workings of the Last Chance were nearing exhaustion and the transfer of the property to the Bunker Hill has been anticipated. The net earnings of the property, during 1916, according to the statement recently filed by the Federal company, amounted to only $95,494, and the announcement that the Bunker Hill will soon take over the mill indicates that the Last Chance is soon to be abandoned by the Federal. The Bunker Hill & Sullivan company will thereby add a large and valuable asset to its extensive holdings.

ST. LOUIS—June 16

Iron Mining in Missouri is again receiving attention. Announcement has been made that mining would again be undertaken at Iron Mountain in Iron County by the recently formed Iron Mountain Mining and Smelting Co., of which Franklin M. Smith of Joplin is president. The head offices will be in St. Louis. According to the local papers, modern hydraulic methods are to be employed. The company's property consists of 360 acres of proven iron ore on Big and Little Mountains, which make up the famous Iron Mountain. The company will erect a furnace, either at Iron Mountain or St. Louis. Iron Mountain has produced approximately 4,500,000 tons of ore. Iron mining began in Iron County in 1816, the Iron Mountain property being opened up in 1845. Until a few years ago, this property had been in continuous operation. The ore is hematite, generally, and of the specular type. It occurs in three distinct horizons: (1) boulder ore in the surface clay; (2) primary vein ore in the solid porphyry; and (3) conglomerate ore in beds between the porphyry and the overlying sediments. Weathering has played an important part at Iron Mountain, the porphyry and ore, when exposed, altering to a soft, easily mined rock. The Iron Mountain Mining and Smelting Co. reports that at a depth of 225 ft. its drill encountered a 51-ft. vein of good ore. The ores of Iron Mountain are probably due to a replacement of the porphyry, and fissure filling. In Butler County new iron-mining operations are also in progress. Iron ore was first mined in this county in 1873 from the Hendrickson mine. To date it has shipped approximately 50,000 tons of brown ores, consisting of both the primary and secondary types. Limonite occurs in Cambrian sediments, outcropping in many places, and as a general rule is close to the surface. The secondary deposits consist of pipe and boulder ores, and the primary deposits of coarsely cellular and sandy ore. The Butler Iron Co., an Illinois corporation, capitalized at $2,000,000, own and will soon begin developing 10,000 acres near Poplar Bluff. W. W. Mechling, formerly with the Carnegie Steel Co., and the Forged Steel Wheel Co., of Pittsburgh, Penn., is president of the company. Both surface and underground methods will be employed, but most of the ore will be mined with steam shovels. The company will erect a blast furnace having a daily capacity of 50 tons of pig iron, and a charcoal and wood distillation plant. Several other iron-mining operations in Butler and Wayne Counties are under consideration.

JOPLIN, MO.—June 16

Flotation in Joplin District is now to be undertaken on a serious scale by the Eagle-Picher Lead Co. Manager A. E. Bendelari, is going to run all the tails from the Picher-Netta mill, which amount to about 230 tons daily, through a ball mill and then treat them in a flotation plant constructed by the Picher company itself. The flotation apparatus, while different in some respects, is to be virtually the same as that used in ordinary Minerals Separation plants, and no attempt to evade royalties to this company is to be made. The Picher company has been operating a small flotation plant for almost two years but results have never been made public, it being undertsood that results were not entirely satisfactory.

Largest Air Compressor in Joplin district has been purchased by the Eagle-Picher Lead Co. and will be installed at its central power plant at Picher, Okla. It is an Ingersoll cross-compound condensing compressor with capacity of 4000 cu.ft. of free air at 70 r.p.m. per min. At the central power house at Picher, the company already has three electrically operated compressors with capacity of 1200 ft. each and one with 600 ft. capacity, so the total capacity will soon be 8200 ft. per min. This will be used to operate air drills at all the Picher properties. The largest compressor in the district previous to this machine was one of 2000 cu.ft. capacity installed at the Oronogo Mutual Co.'s power plant at Oronogo, Mo., several months ago. Later another of similar capacity was installed by the Chapman-Hosley Co. at the Schoolhouse mine at Carterville.

WASHINGTON, D. C.—June 18

Suspension of Assessment Work on mining claims, provided in Senator Shafroth's bill, seems assured. The Shafroth bill provides for the suspension, during the war with Germany, if in lieu of such assessment work the sum of $100 in money or in labor is expended in raising or manufacturing products necessary for the maintenance of the army, navy or people of the United States. During the discussion of the bill, several changes of wording were found to be advisable. Senator Shafroth is redrafting the bill, which probably will be ordered reported favorably at the next meeting of the Senate committee on mines and mining.

Alaskan Mining in 1917 has good prospects for a successful year, with increased production of most of the metals except gold. An increase in the copper production of Alaska in 1917 is predicted by Alfred H. Brooks, who is in charge of the Alaskan section of the U. S. Geological Survey. A feature of this estimate is the fact that production in 1916 reached the unexpected figure of 119,600,000 lb. The copper output of Alaska in 1914 was 21,450,000 lb. Mr. Brooks calls attention to the fact that this large output comes almost entirely from two large mines in the Chitina Valley. He urges Alaskan operators to prospect other deposits, especially those of the Pacific seaboard. Since a considerable portion of Alaska's silver is obtained incidentally to the mining of copper, Mr. Brooks anticipates that with the increased output of copper there will be an increase in the territory's silver production. Due to adverse economic conditions, the output of gold from Alaskan mines in 1917 will be less than in 1916, Mr. Brooks predicts. In addition to other adverse conditions, the serious accident to the Treadwell group of mines will cause a decrease in the gold output from the Juneau district. Three hundred tons of metallic tin can be produced in Alaska this year, Mr. Brooks states. Summer mining operations this year should produce no less than 130 tons of scheelite concentrates. He also is of the opinion that 4000 tons or antimony should be obtained from Alaska this year. With regard to platinum, Mr. Brooks says: "The outlook for some platinum production from Alaska during the next two years is hopeful, though as yet there is not a single mine in the territory that has produced more than a few ounces."

Ample Sulphur Supply is reported by P. S. Smith, administrative geologist of the Geological Survey, who just has returned from a visit to the Southern sulphur fields. Mr. Smith finds that a large supply of sulphur is on the surface at the plant of the Union Sulphur Co., in Calcasieu parish, Louisiana, and at the plant of the Freeport Sulphur Co., at Freeport, Texas. He reports that conditions at each place apparently are favorable for the continued production of sulphur in the same volume as that maintained for several years past. The fact that there are large supplies of practically pure sulphur available should be no reason, Mr. Smith thinks, for encouraging its use when less valuable material can be obtained. For this reason he urges the development of domestic pyrite deposits. In addition to using the sulphur obtained from pyrite for the making of sulphuric acid, Mr. Smith believes that sulphur from the same source should be used by the paper-pulp industry. Two-thirds of the pure-sulphur output of the country is consumed by the paper mills. Mr. Smith points out that the European practice is in favor of the use of sulphur from pyrite in the treatment of wood pulp. In the interest of conservation, Mr. Smith will make a report showing the location of all deposits of pyrite, so situated as to warrant development. A number of the state geologists will aid him in the collection of the necessary data. Under conditions which are likely to continue for some time, Mr. Smith believes that large profits can be secured from the operation of some abandoned gold and copper mines, which contain a high percentage of pyrite. Recovery of the valuable metals can be obtained from the cinder after the sulphur has been roasted out.

TORONTO—June 16

New Dome Orebodies being prospected. At the annual meeting of the Dome, held in Toronto, recently, a statement from the president relative to developments since the close of the fiscal year was read. He stated that the company is now driving as fast as possible on the seventh level for the point where diamond-drill hole No. 97 intercepted 61 ft. of ore assaying $16.61. Another section, in advance of the last, gave 47 ft. of $22.38 ore. The total width as shown by the cores was 119 ft., averaging $17.15. The president stated that the orebodies opened up in the lower levels showed an increase in size as compared with those on the upper levels, and he expressed great confidence in the property, the present unfortunate position of which was due to labor troubles. A new director, J. S. Bache, of New York, was elected.

Strike Vote in Porcupine will be taken on Sunday, June 17. The wage scale presented to the managers, together with a request for a conference has been completely ignored, and the miners will take this vote to decide what is to be done. An open meeting will be held in Cobalt on the same date and an executive meeting, behind closed doors, will be held later. At this meeting it will be decided whether or not a strike vote will be called for. It is believed that the Cobalt miners will act independently of the men in Porcupine. The bonuses being paid in Cobalt in addition to the ordinary wage, bring the total up to the scale asked for by the men and as the men would get another bonus of 25c. if silver sells over 80c., the possibility of getting this extra bonus will make the men chary of jeopardizing their position. James Lord, president of the mining department of the American Federation of Labor, has written to the mine managers in Cobalt offering his services to mediate. While the managers have no objection to meeting representatives of their own men, they absolutely refuse to have anything to do with the foreign organization.

MELBOURNE—May 10

Electrolytic Zinc Plant at Risdon, near Hobart, in Tasmania, is expected to go into commission in August, provided no further delays are experienced in regard to the delivery of equipment from England. The first unit, it is estimated, will have a capacity of 10 to 11 tons of high-grade zinc per day, and additional units will be installed when adequate data have been collated. The directors of the Amalgamated Zinc (de Bavay's) Ltd. in their report for the half-year ended Dec. 31, state that the experimental test unit capable of producing 250 to 300 lb. of electrolytic zinc per day, is running and the results confirm those obtained in America. The Zinc Corporation has acquired a one-fifth participation in the Electrolytic Zinc, Ltd., in which the Amalgamated Zinc company holds 100,004 shares.

The Mining News

ALASKA

ALASKA JUNEAU (Juneau)—On June 12, one-third of the new mill was reported to be in commission. No tonnage or recovery figures yet available.

KENNECOTT COPPER (Kennecott)—Miners at the Bonanza and Jumbo mines struck on June 16 for an additional 50c. per day above the present $1 bonus. Work at mines practically at standstill.

ALASKA MEXICAN (Treadwell)—In April, milled 5005 tons of Mexican ore, yielding $8627 or $1.74 per ton. Operating expense $8157; operating profit, $470. Construction expense, $3038; net loss, $2568; sundry income, $5063. Mexican mill also crushed 5390 tons of Alaska United ore and 2100 tons of Alaska Treadwell ore. Mine flooded to tide level Apr. 21.

ALASKA TREADWELL (Treadwell)—In April 225 stamps of 300-stamp mill ran 18 days 17 hours, crushing 22,687 tons and Mexican mill crushed 2100 tons. Yield was $44,166, or $1.80 per ton. Operating expense, $41,447; estimated operating profit, $2719. Construction expense, $13,308; sundry income, $11,838; net profit, $1249. Mine flooded to tide level Apr. 21.

ALASKA UNITED (Treadwell)—Ready Bullion mine produced 21,791 tons in April, yielding $48,558 or $2.25 per ton; operating expense, $41,203; operating profit, $7355; construction expense, $4202; net profit, $3153; sundry income, $2041. The 700-Ft. Claim mine produced 12,005 tons, yielding $25,517 or $2.15 per ton; operating expense, $41,623; operating loss, $16,106; construction expense, $8013; net loss, $24,119; sundry income, $2041. The 700-Ft. Claim mine flooded to tide level on Apr. 21. Ready Bullion production disturbed for few days, after which normal operations were resumed, this being only mine of Treadwell group not affected by the caving.

ARIZONA

Cochise County

CALUMET & ARIZONA (Bisbee)—Production for May was 5,688,000 lb. copper.

Mohave County

GIRARD MINING (Oatman)—Recently made 30-ton shipment of gold ore to Selby smeltery. H. B. Magill, manager.

GOLD ORE (Goldroad)—Plans 250-ton mill; first unit to be 50 tons. Shaft being retimbered; will be continued to the 730-ft. level.

OATMAN SYNDICATE (Oatman)—Consolidation of the Oatman Syndicate, Murdock, Oatman Southern, Associated and Black Range properties expected.

ARIZONA ORE REDUCTION CO. (Chloride)—Concentrating section of mill completed and will be operated independently of auxiliary zinc section which will not be ready for several weeks.

Pinal County

ARIZONA HERCULES COPPER (Ray) Concrete loading bins at No. 1 shaft have been completed. Concrete construction well under way at the 2000-ton concentrator at Kelvin. By terms of order handed down recently by the Corporation Commission, the Ray & Gila Valley R.R., subsidiary of the Ray Consolidated, is to build a line to connect its present line with the mine of the Arizona Hercules company at Ray and also to the mill at Kelvin. The Hercules company to pay cost of construction; refunding the cost out of freight charges on ore to the concentrator will be ruled on later. The Arizona Hercules (operating company of Ray Hercules Copper Co.) has leased power plant of the Kelvin Sultana company to obtain power at Kelvin during construction of mill.

Yavapai County

CONSOLIDATED ARIZONA SMELTING (Humboldt)—May copper production was 1,650,000 lb.; same as in April.

GREAT WESTERN SMELTERS CORPORATION (Mayer)—Men went out on strike about June 12 for higher wages.

UNITED VERDE EXTENSION (Jerome)—Started new shaft in gulch below Calumet & Jerome ground. The four-mile railroad extension completed to smeltery site; steel shipments started from Kansas City, Mo., for smeltery buildings.

ARKANSAS

Marion County

PARNELL (Rush)—Company starting to mill ore from O'Meara mine on Buffalo River. Two cars crystalized carbonate made from dump.

YELLOW ROSE (Rush)—Company is operating White Eagle zinc mine; building 500-ft. trestle to mill from new deposit opened on mountainside. Installing crude-oil engines and tables in mill on its Silver Hollow property.

CALIFORNIA

Amador County

HARDENBERG (Jackson)—Shaft deepened from 1000-ft. to 1400-ft. point since development was begun by the Loring interests. Will continue to 1500 ft. before undertaking lateral work.

PLYMOUTH CONSOLIDATED (Plymouth)—New oreshoot disclosed in southern section of higher grade than heretofore encountered. This is at the 1200 level and apparently was worked by former owners. Profit of about $22,000 a month is being earned.

Butte County

ROYAL DRIFT (Forest Ranch)—New pumping machinery recently installed. Forrest H. Snow, superintendent.

SPRINGER CONSOLIDATED (Magalia)—Milling installation completed including ball mills in 4 units, rock crusher, ore bins and other necessary surface equipment. Plant will be situated a mile east of De Sabla.

NATOMAS CO. (Oroville)—Repairing and repainting Feather No. 1 and No. 3 dredges. These wooden-hull boats are in good order with exception of certain new machinery. It was believed that the Natomas ground would be exhausted by the time these boats were ready to be rebuilt or in need of extensive repairs. Additional ground has been secured in vicinity of ground being dug by No. 4, insuring employment of Nos. 1 and 3 for long period. Some of the old tailings may be redredged.

Nevada County

ALLISON RANCH (Grass Valley)—Water lowered to 400-ft. level. Additional pump will be installed. All ground so far unwatered carefully sampled; some high-grade ore.

OROVILLE GOLD DREDGING CO. (Grass Valley)—Prospecting ground situated between Grass Valley and Wheatland. Portions of this area once dredged.

WASHINGTON DISTRICT is attracting attention. Columbia Consolidated is crushing good ore and may add to mill. Ocean Star will install 10-stamp mill. Red Ledge is producing high-grade ore. Eagle Bird being unwatered; may be developed.

Plumas County

U. S. SMELTING, REFINING AND MINING EXPLORATION CO. (Taylorsville)—Satisfactory results said to have been obtained in development of Five Bears, Eagle Hill, Iron Dike and other optioned properties. Development now being undertaken on the Native Son, Austrian and others.

Shasta County

MOUNTAIN COPPER CO. (Keswick)—Old Minnesota mine is being recovered from caving that occurred several years ago. Tunnels and drifts aggregating 1100 ft. are to be straightened and retimbered.

Siskiyou County

DEWEY (Gazelle)—The 10-stamp mill treating good-grade ore; 15 men at work. F. A. Wright, manager.

UNCLE TOM (Yreka)—Graphite reported in small quautities; 200 lb. said to have been shipped recently. Graphite is known in Humbug Mountains but miners have paid but little attention to it.

SPRING GULCH TUNNEL CO. (Yreka)—Wacker group of 17 claims optioned by Seattle men under management of Ambrose B. Ernst. Surface equipment of the Mono group on Humbug Creek purchased, including a 25-ton sampling mill. Water supply is being developed. Have also optioned Mono group.

COLORADO

Clear Creek County

PRIMOS CHEMICAL CO. (Empire)—Will reopen molybdenum mine at Camp Boericke in Daley district 11 miles west of town; snow now being shoveled from roads. In 1915 production of 48 cars made.

Gilpin County

AMERICAN METALS CO. (Blackhawk)—Custom ores now being treated. Jigs and trommels added to lead-ore section.

FLAGLER (Central City)—Shaft being sunk on Silver Glance claim at lower elevation than tunnel. At depth of 50 ft., 15-in. shoot of high-grade lead-silver ore carrying some ruby silver opened; one shipment made.

Lake County

FANNY RAWLINS (Leadville)—Reported richest ore ever found in mine being sacked for shipment. Regular shipments of ore assaying $40 gold being made from shoot alongside the high-grade streak.

Ouray County

VERNON (Ironton)—Building 60-ton mill, to be completed Aug. 15, to treat ore from four parallel shoots in the South Dakota vein above 300 level; then planned to sink to 500-ft. level and drive long main drift on one orebody, exploring others by diamond drilling at suitable intervals. A. G. De Golyer, manager.

San Juan County

SHIPMENTS FROM SILVERTON of crude ore and concentrates during May were as follows: To outside smelteries, Gold King Leasing Co., 40 cars; Sunnyside, 24 cars; Iowa-Tiger, 23; Highland Mary and Silver Ledge, 10 cars each; Pride of the West, 9; Kittimac and Mayflower, 7 each; Silver Lake Custom mill, 6; Dives Leasing Co., 4; Hamlet, 2; Hematite Leasing Co., Big Giant and Allen & Fattor, 1 car each; miscellaneous, 3 cars; total 148 cars. Shipments to Silver Lake Custom Mill: Champion, 11 cars; Lackawana, 3; Fairview, 1; total, 15 cars.

San Miguel County

MAY SHIPMENTS of concentrates from Telluride district: Smuggler-Union and Black Bear, 42 cars; Tomboy, 50 cars; Liberty Bell, 11 cars; Inama & Perino Leasing Co., 2 cars; total, 105 cars. Shipments curtailed in May by railroad blockade.

Teller County

ELKTON (Elkton)—Twenty-two sets of lessees operating through main shaft; other lessees working through Tornado and Thompson shafts.

HULL CITY (Victor)—The Vindicator company has reopened this property on the sixth level of the Hull City shaft. Ore is being broken on the east vein system both on company account and by lessees. Shipments will be made during June. Charles Walker, superintendent.

IDAHO

Blaine County

UNION MINES CO. (Fairfield)—This Spokane company is remodeling the 10-stamp mill on the Bluebird mine, adding rolls and jigs. New tunnel to give 175-ft. additional depth will be driven. J. L. Magney, manager.

Custer County

EMPIRE COPPER (Mackay)—New compressor plant at Cossack tunnel nearing completion; will give 1300 cu.ft. free air per minute; now awaiting air pipe, upon receipt of which the driving of 1000-ft. four-compartment raise, between the Cossack and Alberta levels, will be started. Contract just let for 560-ft. four-compartment raise between Alberta and Davis levels. These two raises will permit more economical operation. Bids being received for 16,300-ft. aërial tramway to have 50-ton capacity at first; ultimately 125 tons per hour. Mine being opened systematically while shipments to smeltery are curtailed. F. A. Behling, manager.

Shoshone County

BIG CREEK (Wallace)—Lease on upper ground of Big Creek Mining Company surrendered and company will ship ore. Crosscut, being run 560 ft. below leased ground, is in 1300 ft. leaving 1000 ft. to go. Ore is tetrahedrite.

HYPOTHEEK (Wallace)—Quarterly report shows net value of smelter returns $40,901; costs, $26,171, leaving net profit for period, $14,730. Impassable roads reduced shipments during latter part of March and April.

SUCCESS (Wallace)—Will resume payment of dividends soon, probably in August. Suspended dividends last summer. Large bodies zinc-lead ore developed on 1400 and 1500 levels, after exploring lean ground on 1100, 1200 and 1300. Now shipping 2000 tons concentrates per month. Also announced that option on Custer County lead mine surrendered on account of inability to get machinery for mill in reasonable time. Mine is 60 miles from railroad.

MICHIGAN

Copper

AHMEEK (Ahmeek)—New turbine plant at Nos. 3 and 4 shaft engine house is in operation; load being transferred from former direct-current plant.

SOUTH LAKE (Houghton)—Best showing so far by any crosscut in the Butler lode from shaft on sixth level; in about 75 ft. the last 25 ft. carrying much copper.

NORTH LAKE (Lake Mine)—About 300 ft. of drifting on new lode meeting continually with commercial copper. Nothing of importance encountered in the northwest crosscut.

NEW ARCADIAN (Houghton)—Has 500 ft. of drifts on bottom level. New compressor will be in operation soon. Last of the stock pile being shipped to the Franklin mill.

SUPERIOR (Houghton) — Transferring some of its men to other C. & H. subsidiaries, as it is not doing so much development work. Awaiting results from lower levels. Tonnage maintained.

FRANKLIN (Demmon)—Stoped out on the twenty-ninth north level; allowed to cave. Mechanical haulage will be installed on the twenty-seventh level; will be compressed-air installation, on account of better deliveries.

Iron

BRISTOL (Crystal Falls)—Mine shut down for indefinite period. Ore, high in phosphorous, could not be sold.

PRINCE OF WALES (Negaunee) — Mine closed June 1. Ore exhausted. Last of Queen group of the Oliver Iron Mining Co. The Oliver company now has only two mines in operation on the Marquette Range; Section 16 at Ishpeming, and the Stegmiller at Gwinn. Latter will be exhausted before end of month.

LAKE ANGELINE (Ishpeming)—Shovels started loading ore from pits. Was formerly an underground mine. Ore runs from 67 to 69% in iron, and from 0.017 to 0.030 in phosphorous. Brings big premium in the market. Mine was sold at auction for $27,000. Will ship about 100,000 tons this year. Underground mining to be done later.

MISSOURI

Joplin District

D. C. & E. (Webb City)—Will start No. 4 mill soon; 300 tons capacity. J. J. McLellan, manager.

F. L. YALE (Joplin)—Sold lease on 200 acres of land just south of Baxter Springs for $12,000, after drilling.

REPUBLIC (Miami, Okla.)—Preparing to build two new mills on 120-acre lease of Brewster land, in Oklahoma, just south of Baxter Springs, Kan.

DEWDROP (Picher, Okla.)—New mill completed on tract half-mile west of Picher mines. Washington Adams and Will F. Plummer, principal owners.

LUCKY SIX (Peoria, Okla.)—Leased Geboe land; made good strike in new shaft. Will erect mill. Owned by Shawnee, Okla., men, including W. A. Ephland and J. M. Meek.

UTOPIA (Joplin)—Drifting at 149-ft. level; encountered fine run of ore. Mine short distance east of Welsh mines at Century, Okla.; owned by Church & Wright, of Joplin.

VINEGAR HILL (Baxter Springs, Kan.) —New mill near Blue Mound mine, west of Baxter, ready for operation. Developing, by drilling, another mill site on Campbell land of Cooper estate.

DE ARMOND (Joplin)—Will build new 300-ton mill on 52-acre lease of Wright land, near Baxter Springs, Kan. Ore at 176 ft. Is sub-lease of Walker Mining Co. Edward Nix, Oklahoma City, Okla., manager.

O. W. SPARKS (Galena, Kan.)—Has opened excellent prospect on Missouri Lead and Zinc Co. land at Joplin. At 147 ft. new shaft in ore much of which shows 35% of blende. Hand jigs will be used for the present.

MONTANA

Silver Bow County

BUTTE OUTPUT temporarily curtailed about 30% by the North Butte mine fire but a number of the surrounding mines are resuming or preparing to resume.

NORTH BUTTE (Butte)—Death toll at Granite Mountain mine fire now placed at 160. Shaft timbering burned from 1600 to 2800 level; property damage not excessive. Operations can be resumed through Speculator shaft, open to 3000-ft., as soon as gases are cleared; recently retimbered; only slight repairs will be necessary.

ANACONDA (Butte)—Pilot Butte mine resumed operation June 12, having been closed on account of North Butte mine fire; other adjoining mines will reopen as fast as conditions permit. Sinking of Bonanza shaft in silver-zinc section proceeding at rapid rate; now below 500 ft.; will crosscut at 1000 ft. Zinc production for May was 6,250,000 lb.

NEVADA

Esmeralda County

GOLDFIELD CONSOLIDATED (Goldfield)—Milled in April 27,000 tons yielding 15,007. Net costs, $4.869 per ton. Did 1501 ft. of development.

Nye County

TONOPAH ORE PRODUCTION for week ended June 9 was 8618 tons, valued at $155,124, comparing with 9133 for the week previous. Producers were: Tonopah Belmont, 2459 tons; Tonopah Mining, 1800; Tonopah Extension, 2380; Jim Butler, 650; West End, 953; Rescue, 252; Montana, 36; Cash Boy, 50, and MacNamara, 38 tons.

CONSOLIDATED SPANISH BELT (Belmont)—Road completed and foundations for compressor and other machinery being laid. W. J. Pike, superintendent.

LOUISIANA CONSOLIDATED (Tonopah)—Sacking for shipment high-grade silver-lead ore from old dump and from 400 level of Tybo mine, about 65 miles northeast of Tonopah. Otto F. Heiser, superintendent.

Ormsby County

PANAMA CANAL MINES CO. (Carson City)—This company has bonded the Panama Canal group of silver claims about 6 miles south. Drifting on vein from tunnel giving vertical depth of 120 ft. L. A. Thomas, manager.

Storey County

ANDES (Virginia)—Saved 132 cars from 350 level, average assay $9.10 per ton.

JACKET (Gold Hill)—Sent 120 tons to gloryhole; saved 33 cars from surface tunnel.

SIERRA NEVADA (Virginia)—Mine produced during week 46 tons of ore assaying $15.64.

CON. VIRGINIA (Virginia)—Southwest drift 2700 level advanced to 232-ft. point. Extracted from second floor 22 cars ore assaying $16.36 per ton. Concrete foundation being laid for electric hoist at head of Con. Virginia winze.

UNION CON. (Virginia) — Extracted from 2500 level 170 tons of ore, average assay value $13.24. From 2600 level extracted 42 tons averaging $12.64. Completed installation of hoist at 2700 station, Union shaft. Shipped to Mexican mill 212 tons of ore, average assay $13.55.

MEXICAN (Virginia)—Extracted from 2700 level 24 tons of ore, average assay $14.02. Installed 15-in. air pipe, etc., on 2900 level. Mexican mill ran 86% of the time. Crushed 24 tons Mexican ore, 212 tons Union, 47 tons Sierra Nevada, 109 tons Mexican Wedge, 141 tons, Con. Virginia. Shipped 4 bars bullion to Selby.

Washoe County

WASHINGTON & NEVADA DEVELOPMENT (Carson City)—Company starting work on gold-silver property between Washoe Lake and Virginia City. Vein 4 to 20 ft. wide. Deepest shaft, 150 ft. on vein, shows 4 ft. of ore at bottom. Some high-grade ore, but expect mainly milling ore. Oren H. Du Bois, manager.

NEW HAMPSHIRE

Grafton County

ALTA ENGINEERING CORPORATION (Canaan)—Operating Star mica mine for both mica and feldspar. Quarry has nearly 1000-ft. face. Mica occurring in pockets and veins is picked out after blasting. James H. Strain, superintendent. New York offices, 50 Hudson Terminal.

TENNESSEE

Carter County

BAUXITE deposit, near Elizabethton, owned by H. E. Graves, of Bristol, has been purchased by J. E. Baum and associates of Philadelphia, Penn. Adjoins property formerly operated by Merrimac Chemical Co. A drier and washing equipment, as well as a mining plant, is being installed. Edmund Putnam, manager.

CANADA

Ontario

IRON MOUNTAIN, in Sudbury district, is being developed for iron ore with crew of 150 men. Milling unit of 300 tons daily capacity installed. Spur being built to main line of the Canadian Northern; concentrates will be briquetted and sent out to be smelted.

CRŒSUS (Munro Township)—Ball mill installed; other equipment arriving.

DAVIDSON (Porcupine)—First unit of mill purchased. Expected to be operating before winter.

LAKE SHORE (Kirkland Lake)—Another 4-ft. vein encountered in crosscutting on 200-ft. level.

T. C. 177 MINING CO. (Gowganda)—Commenced operations on property adjoining Miller Lake-O'Brien; will sink to 300-ft. level.

OPHIR (Cobalt)—A 6-in. low-grade silver vein, discovered south of shaft No. 2, will be developed on the Keewatin-diabase contact.

HOLLINGER (Timmins)—Stopped construction on addition to mill; plant is nearly completed and needs comparatively little more work to bring mill capacity to over 3000 tons a day.

DOME (South Porcupine)—Mill heads in May ran only $3.25 a ton. At 700-ft. level, main crosscut is being driven toward what appears to be largest orebody in mine—about 120 ft. wide—as indicated by diamond drilling.

NIPISSING (Cobalt)—In May mined ore valued at $261,668; shipped bullion from Nipissing and customs ore valued at $405,600. No new veins opened during month, but current development on known orebodies was satisfactory.

WEST DOME CONSOLIDATED (Porcupine)—Over 1200 ft. of underground workings completed at 300-ft. level, where it is estimated that between 60,000 and 70,000 tons of $9 ore are blocked out. Operations confined to this level to increase ore reserve before installing mill.

MEXICO

TIGRE (Esqueda)—Reported that 350 Mexican miners have struck, practically tying up operations.

AMERICAN SMELTING AND REFINING (Aguascalientes)—This company's Aguascalientes plant resumed operation on June 11; two copper furnaces are in blast. At Monterey, N. L., three lead furnaces are operating, and at Matehuala, S. L. P., three copper furnaces. Conditions in vicinity of Chihuahua and Velardeña do not yet warrant resumption.

CUBA

MINERAL EXPORTS to the United States in 1916, according to U. S. Consul General James L. Rodgers of Havana, were: Copper ore, 121,722 tons; iron ore, 746,131 tons; manganese ore, 52,972 tons. In 1915, exports were: Copper, 58,488 tons; iron, 796,830 tons; manganese, 5144 tons.

UNION OIL CO. (Havana)—This company's No. 5 well which produced about 15 bbl. per day by pumping, was "shot" on June 2 and began flowing at the rate of 100 bbl. a day. The 8-in. pipe has been capped and two 2-in. outlets inserted.

COSTA RICA

COSTA RICA MANGANESE AND MINING CO. (Playareal)—Operating manganese deposits along Pacific Coast, on west side of Peninsula of Nicoya. Loading steam vessels with bulk ore (51% Mn, 4% SiO_2) for shipment to affiliated American Manganese Manufacturing Co. at Dunbar, Penn., U. S. A. Also ship chemical-grade ore in sacks. A. M. Yonge, manager.

COLOMBIA

PATO MINES (Zaragoza)—Dredge yield from Apr. 25 to May 15 was $25,236 from 93,190 cu.yd., or about 27c. per cu.yd.

NECHI MINES (Zaragoza)—Gross yield from dredge Apr. 15 to May 13 was $63,771 from 182,029 cu.yd., or 35c. per cu.yd.

The Market Report

Metal Markets

SILVER AND STERLING EXCHANGE

June	Sterling Exchange	Silver New York, Cents	Silver London, Pence	June	Sterling, Exchange	Silver New York, Cents	Silver London, Pence
14	4.7545	77	39 1/16	18	4.7545	77 1/8	39 1/8
15	4.7545	77	39 1/16	19	4.7545	77 1/8	39 1/8
16	4.7545	77	39 1/16	20	4.7540	77 1/8	39 1/8

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine.

DAILY PRICES OF METALS IN NEW YORK

June	Copper Electrolytic	Tin Spot.	Lead N. Y.	Lead St. L.	Zinc St. L.
	29 1/2		11	11	9 1/2
14	@30 1/2	61 1/4	@11 1/4	@11 1/2	@9 1/4
	29 1/2		11	11	9.20
15	@30 1/2	62	@11 1/4	@11 1/2	@9.30
	29 1/2		11	11	9.20
16	@30 1/2	62	@11 1/4	@11 1/2	@9.30
	29 1/2		11	11	9.20
18	@30 1/2	63 1/4	@11 1/4	@11 1/2	@9.30
	29 1/2		11	11	9 1/4
19	@30 1/2	63 1/4	@11 1/4	@11 1/2	@9 1/4
	29 1/2		11	11	9 1/4
20	@30 1/2	63 1/4	@11 1/4	@11 1/2	@9 1/4

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for the deliveries constituting the major markets, reduced to basis of New York, cash, except where St. Louis is the normal basing point.

The quotations for electrolytic copper are for cakes; ingots and wirebars. Electrolytic copper is commonly sold on "regular terms" (r.t.), including freight to the buyer's works and is subject to a discount for cash. The difference between the price delivered and the New York cash equivalent is at present about 0.25c. on domestic business. The price of electrolytic cathodes is 0.05 to 0.10c. below that of electrolytic. Quotations for spelter are for ordinary Prime Western brands. We quote New York price at 17c. per 100 lb. above St. Louis.

Some current freight rates on metals per 100 lb. are: St. Louis-New York 17c.; St. Louis-Chicago, 6.3c.; St. Louis-Pittsburgh, 13.1 cents.

LONDON

June	Copper Standard Spot	Copper Standard 3 Mos.	Copper Electrolytic	Tin Spot	Tin 3 Mos.	Lead Spot	Zinc Spot
14	130	129 1/2	142	238 1/4	236 1/4	30 1/2	54
15	130	129 1/2	142	241	239 1/2	30 1/2	54
16	....	....	....	....	....	....	....
18	130	129 1/2	142	249	246 1/2	30 1/2	54
19	130	129 1/2	142	....	....	30 1/2	54
20	130	129 1/2	142	....	....	30 1/2	54

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2,240 lb. For convenience in comparison of London prices, in pounds sterling per 2,240 lb., with American prices in cents per pound the following approximate ratios are given, reckoning exchange at 4.80. £15 = 3.21c.; £20 = 4.29c.; £30 = 6.43c.; £40 = 8.57c.; £60 = 12.85c. Variations, £1 = 0.21 1/4c.

NEW YORK—June 20, 1917

The markets came almost to a standstill this week, owing to uncertainty about what the Government is going to do in providing for its supplies. Matters are up to Secretaries Baker and Daniels, who do not seem to be able to make up their minds. The Advisory Commission can advise, but do nothing more. Apparently its advices carry no weight with the heads of the departments who must act. Probably it will remain for the President to determine on the policy of the Government and prod his cabinet ministers to act, lest the interests of our industries, and consequently of the nation, suffer too seriously.

Copper, Tin, Lead and Zinc

Copper—Sales were very light, the aggregate for the week being only a few million pounds and quotations are therefore more or less nominal. The outstanding feature was the disappearance of a good deal of the premium on near-by copper. A week ago supplies for early delivery were supposed to be nonexistent, but when buyers ceased to beg for it there appeared to be plenty and the report today was that July copper could be bought at 31 1/2c., r.t., but could not be sold at that. The indications were that anybody who might make a firm bid of 31c., r.t., for spot copper would get it. There was an easier tone to the market in all positions. At the close, July-August copper was offered at 30 3/4c., r.t.; July-September, at 30 1/4c., r.t.; August-September, at 29 3/4c., r.t.; August-December, at 29 1/2c., r.t.; October-December, at 29c., r.t., with sales at that price.

Owing to the strike at Anaconda, which attained serious proportions, some large producing interests were disposed to hold aloof.

It was reported today that Secretary Daniels had stated that he is going to leave the price of copper for Government requirements to be determined by the Federal Trade Commission on the basis of average cost of production, allowing a liberal profit to the producers. Not much attention was paid to that report, however, it being the opinion in important quarters that a price would be reached by agreement, and through the influence of the men of broader vision in Washington, that would be inspiring to the producers to turn out every pound of copper possible in view of the urgent need for the maximum supply.

The Chinese bronze currency continues to be steadily drawn on by Japanese buyers, the profit on melting for the recovery of the copper and zinc obtained being reckoned about double the cost of purchase, collecting, and melting. According to an estimate of the "Manchuria Daily News" the copper cash circulating in China amounts to 52,501,235,000 pieces, the total cost of which amounts to $26 per 100 kin, or 1.1 cwt., and the selling price to $50. The export per month from Shantung alone is estimated still at 5000 kin.

Copper Sheets—The price of copper sheets has advanced 1c. per lb. since last week. We quote hot rolled at 39c. per lb., cold rolled 1c. higher. Wire now quoted 35c. f.o.b. mill.

Tin—The market was very narrow, the failure of London cables—not even private dispatches—to come through on several days producing a feeling of uncertainty. Banka tin advanced a little more proportionately than Straits, being quoted at 58c. at the beginning of the week, and 61 1/4c. at the close.

Lead—Sales were light, such as there were being distributed among numerous relatively small transactions. Business was done for June, July and August deliveries, some sellers asking the same price for each, while others held July at 11 1/8@11 3/8c., New York, and August at 11 1/4@11 1/2c., these quotations being at the close. Sales of June lead were made by producers right through the week at 11 1/2c., St. Louis. There was no question about there being an easier tone in the lead market.

The new Bunker Hill smeltery and refinery at Kellogg, Idaho, has started operations. L. Vogelstein & Co., Inc., of New York will dispose of the bulk of the product as Eastern selling agents, while the trade on the Pacific Coast will be handled by the company. Offices: Crocker Building, San Francisco, Calif.

It is said that the production of lead by the United States Smelting Co. will be about 30,000 tons in the first six months of 1917 against about 25,000 tons in the corresponding period of 1916.

Zinc—This metal was dull and lower. At the close any deliveries could be bought at 9 1/2@9 1/4c. High-grade spelter could be bought at 13c. and intermediate, at 12c., New York. Brass special was sold at 9 3/4c., St. Louis.

Zinc dust was quoted at 15c.

It is reported that a considerable quantity of zinc money will shortly be minted in Germany to replace silver and nickel coin.

Zinc sheets—Price of zinc sheets has not been changed. Market is still at $19 per 100 lb. f.o.b. Peru, Ill., less 8% discount.

Other Metals

Aluminum—The aluminum market continues quiet and without any new features of special interest. Quotations continue at about the same level. 59@61c. per lb. for No. 1 ingots at New York.

Antimony—This market was dull and unchanged at 19 3/4c. for spot. July shipment from China was quoted at 15 1/2c., c.i.f., New York, duty unpaid.

Bismuth—Quoted at $3@3.50 per lb.

Cadmium—Quoted at $1.50 per lb.

Cobalt—Quoted at $1.70 per lb.

Nickel—The market remains steady at 50@55c. per lb. for nickel. Electrolytic commands an additional 5c. per lb.

Quicksilver—Dull and weaker at $83, New York. San Francisco reports by telegraph, $84, weak.

Gold, Silver and Platinum

Gold—Coin to the amount of $400,000 has been withdrawn from the New York subtreasury for shipment to Cuba. Canada has handled $1,000,000,000 in bullion for the Imperial Government since the beginning of the war.

Silver—Owing to smaller shipments to London, the limited stock of silver in that market has been materially reduced. As a result the price has advanced beyond the figure which would have been reached had sufficient supplies been available in London to meet the wants of the domestic trade and the requirements of the Allies. Silver has been going forward freely to India by way of San Francisco and this course of the bullion has prevented the London stocks from being supplied along the lines which previously obtained.

Platinum—The market was quiet at $105.

Palladium—The demand for this metal was again strong, leading to a further advance in price. We quote $108@110.

Zinc and Lead Ore Markets

Platteville, Wis., June 16—Blende, basis 60% Zn, $80 for premium ore down to $75 for medium grade. Lead ore, basis 80% Pb, $132 per ton. Shipments reported for the week are 2844 tons of zinc ore, 236 tons of lead ore, and 549 tons of sulphur ore. For the year to date the figures are: 63,560 tons of zinc ore, 2808 tons of lead ore, and 12,161 tons of sulphur ore. Shipped during the week to separating plants, 3138 tons of zinc ore.

Joplin, Mo., June 16—Blende, per ton, high $82.20; basis 60% Zn, premium ore $80, medium to low, $76@70; calamine per ton, basis 40% Zn, $45@40; average selling price, all grades of zinc, $72.58 per ton.

Lead, high $132; basis 80% Pb, $130; average selling price, all grades of lead, $125.

Shipments the week: Blende, 10,624 tons, calamine, 1059 tons, lead, 1925 tons. Value, all ores the week, $1,088,650.

With the mines in the sheet ground area now down and those preparing to close up their business there will be a loss of production of 40 to 50 carloads per month by the first to middle of July. Army recruiting is beginning to have a noticeable effect on the labor situation, and there is a growing discontent among miners over low wages and high cost of living.

Other Ores

Antimony Ore—Unchanged and firm at $2.30 per unit.

Iron Ore—Prices delivered lower Lake ports, are for old range bessemer, $5.95; Mesabi bessemer, $5.70; old range nonbessemer, $5.20, and Mesabi nonbessemer, $5.05.

Pyrites—Spanish lump ore, guaranteed 50% sulphur, is worth about $17.25 per long ton in Atlanta and Birmingham, if charters can be obtained. The cost at coast ports is about $15 per 2240 lb. For high-grade pyrites concentrates, guaranteed 48 to 52% of sulphur, purchasers are offering 22c. per unit f.o.b. cars at shipping points. For Domestic lump ore, buyers are offering 25c. per unit, cinders reserved, f.o.b. cars at shipping points, 42% guaranteed. Cinders sell for road-making at $1.10 per long ton, f.o.b. works.

Molybdenum Ore—Firm at $2.10@2.20 per lb. of molybdenum sulphide in molybdenite. Very little ore is offered.

Manganese Ore—Firm at $1 per unit for 49% ore, which was paid, delivered at New York.

Tungsten Ore—Urgent demand continues. The market is quoted at $20@22 per unit for the highest grade of ore.

Chrome Ore—Unchanged at $1 per unit for 42%, continued shortage of Eastern spot.[1]

Strontium Ore—The 80% carbonate, ground to 200-mesh; quoted at 8c. per lb.[1]

Iron Trade Review

NEW YORK—June 20

While the question of Government prices for steel products is being made a political football in Congress, says "Iron Age," with no outcome yet from the jumble of price-fixing by conflicting departments, boards and committees, the markets both for iron and steel go on advancing with no signs of control. Many producers have stopped selling in the face of high offers from eager consumers.

PITTSBURGH—June 19

There are further advances in finished-steel prices, new high prices being established by limited sales by independents. The Steel Corporation is out of the open market, while none of the independents will sell for far forward deliveries, the result being that the market is made by prices obtainable on early deliveries, within a few months, and there are few mills that can offer such deliveries. Thus the quotable market advances sharply although the fact is that the large consumers are not buying except in a limited way. The prices range from $15 to $50 a ton higher than the average prices at which actual deliveries are now being made. A somewhat extreme instance of the state of affairs is furnished by the sheet market. Oct. 12, 1916, the leading interest opened its books for the present half year, at 3.40c. for black sheets. Early in April it opened its books for second half, at 5.50c. for bessemer and 5.75c. for open-hearth. It is two months behind in deliveries, so that it is far from shipping any of the higher priced tonnage, yet the independents, for what little they sell, are securing 8c. to 9c. Probably the sheet market will break before buyers contract for the first half of next year.

At this writing at least two of the independent wire mills have put out new wire prices, based on $4 for nails, against $3.50, the last formally announced price, and the other independents are expected to follow at once. Two independent pipe mills have advanced prices variously on the different sizes by more than $10 a ton.

Government requirements in steel will prove much heavier than expected and may reach 40 or 50% of the output, including steel purchased for account of the Entente Allies, but the purchases are being arranged very slowly as the requirements in the finished products must first be formulated and then shops found to work up the steel from the mill form. The largest single item will be steel for the freighters. Contracts for these vessels are being let almost daily, the Government to fix the price on the steel some time, but the shipyards to do the actual buying. General Goethals has fixed one set of prices and Chairman Denman of the Shipping Board has not named much lower prices, each explaining that the prices are subject to revision. Another large item will be steel for freight cars, perhaps 100,000.

Pig Iron—While the pig-iron market is described as strong and active, prices are not going up as rapidly as they were. Last important sales of basic were at $50, valley, the quotation of a week ago, while a $52 sale is now rumored and sellers generally are asking $53. Bessemer remains at $55. Foundry has advanced, with very few sellers in the market, and is now $50@53, valley, depending on tonnage and delivery.

[1]Quotations supplied by Foote Mineral Co., Philadelphia.

STOCK QUOTATIONS

N. Y. EXCH.†	June 19
Alaska Gold M.	5⅛
Alaska Juneau	4⅞
Am.Sm.&Ref.,com.	106⅛
Am. Sm. & Ref., pf.	‡113⅛
Am. Sm. Sec., pf. A	99⅛
Am. Sm. Sec., pf. B	92
Am. Zinc	31⅛
Am. Zinc, pf.	62⅛
Anaconda	82⅛
Batopilas Min.	1
Bethlehem Steel	145½
Bethlehem Steel, pf.	118½
Butte & Superior	41⅛
Cerro de Pasco	36⅛
Chile Cop.	21⅛
Chino	57
Colo.Fuel & Iron	51⅛
Crucible Steel	79⅛
Dome Mines	9⅛
Federal M. & S.	17
Federal M. & S., pf.	44
Great Nor., ore ctf.	32⅛
Greene Cananea	42⅛
Gulf States Steel	123
Homestake	100
Inspiration Con.	62⅛
International Nickel	39⅛
Kennecott	45⅛
Lackawanna Steel	95⅛
Miami Copper	40⅛
Nat'l Lead, com.	56⅛
National Lead, pf.	108
Nev. Consol	24
Ontario Min.	5⅛
Quicksilver	1⅛
Quicksilver, pf.	1⅛
Ray Con.	28⅛
Republic I.&S.,com.	89⅛
Republic I. & S. pf.	103⅛
Sloss-Sheffield	58⅛
Tennessee C. & C.	18⅛
U. S. Steel, com.	127⅞
U. S. Steel, pf.	117⅛
Utah Copper	110
Va. Iron C. & C.	70

N. Y. CURB†	June 19
Big Ledge	2⅛
Butte & N. Y.	1⅛
Butte C. & Z.	11⅛
Caledonia	.57
Calumet & Jerome	1⅛
Can. Cop. Corpn.	2⅛
Carlisle	5
Cashboy	.07½
Con. Ariz. Sm.	2⅛
Con. Coppermines	6
Con. Nev.-Utah	.09
Emma Con.	1 3/16
First Nat. Cop.	2⅛
Goldfield Con.	.51
Goldfield Merger	.06⅛
Greenmonster	1 3/16
Hecla Min.	8⅛
Howe Sound	5⅛
Jerome Verde	1⅛
Joplin Ore & Spel.	‡.15
Kerr Lake	4 3/16
Magma	44¼
Majestic	.40
McKinley-Dar-Sa.	.48
Mohican	.66
Mother Lode	.28
N. Y. & Hond.	.12
Nipissing Mines	7⅛
Ohio Cop.	1⅛
Ray Hercules	3⅛
Rochester Mines	.53
St. Joseph Lead	18⅛
Seneca	‡10⅛
Standard S. L.	⅛
Stewart	1/16
Success	.39
Tonopah	⅛
Tonopah Ex.	⅛
Tribullion	⅛
Troy Arizona	.25
United Cop	⅛
United Verde Ext.	38⅛
United Zinc	4⅛
White Knob, pf.	1⅛
White Oaks	2
Yukon Gold	1⅛

SAN FRAN.*	June 19
Alta	.03
Andes	.09
Best & Belcher	.03
Bullion	.01
Caledonia	.11
Challenge Con.	.01
Confidence	.10
Con. Virginia	.24
Gould & Curry	.01
Hale & Norcross	.05
Jacket-Cr. Pt.	.03
Mexican	.13
Occidental	.65
Ophir	.11
Overman	.04
Savage	.08
Seg Belcher	.02
Sierra Nevada	.16
Union Con.	.22
Utah Con.	.01
Belmont	4.00
Jim Butler	.73
MacNamara	.22
Midway	.11
Mont.-Tonopah	.20
North Star	.10
Rescue Eula	.23
West End Con.	.66
Atlanta	.11
Booth	.07
Comb. Frac.	.04
D'field Daisy	.03
Florence	.21
Jumbo Extension	.34
Kewanas	.13
Nevada Hills	.28
Nevada Packard	.34
Round Mountain	.35
Silver Pick	.10
White Caps	1.30
Big Jim	.74
Tom Reed	‡1.93⅛
United Eastern	4.37½

BOSTON EXCH.*	June 19
Adventure	2⅛
Ahmeek	100
Algomah	.65
Allouez	61
Ariz. Com., ctfs.	14⅛
Arnold	.30
Bonanza	.21
Butte-Balaklava	.50
Calumet & Ariz.	.79½
Calumet & Hecla	.530
Centennial	18
Copper Range	60⅛
Daly West	2
Davis-Daly	6
East Butte	12⅛
Franklin	7
Granby	83
Hancock	14
Hedley	15
Helvetia	.40
Indiana	2
Island Cr'k, com.	76
Isle Royale	31
Keweenaw	1⅛
Lake	12⅛
La Salle	3
Mason Valley	6
Mass	12⅛
Mayflower	2⅛
Michigan	2⅛
Mohawk	91⅛
New Arcadian	‡3
New Idria	15
North Butte	17
North Lake	1
Ojibway	1⅛
Old Dominion	59
Osceola	89
Quincy	84
St. Mary's M. L.	81
Santa Fe	1 3/16
Shannon	8⅛
Shattuck-Ariz.	26⅛
So. Lake	3⅛
So. Utah	.17
Superior	9
Superior & Bost.	4⅛
Trinity	4⅛
Tuolumne	1⅛
U. S. Smelting	59⅛
U. S. Smelt'g, pf.	50⅛
Utah Apex	2⅛
Utah Con.	15⅛
Utah Metal	4⅛
Victoria	4
Winona	3⅛
Wolverine	42⅛
Wyandot	‡.90

BOSTON CURB*	June 19
Alaska Mines Corp.	.75
Bingham Mines	12⅛
Boston Ely	.45
Boston & Mont.	.62
Butte & Lon'n Dev.	.16
Calaveras	3⅛
Calumet-Corbin	.01⅛
Chief Con.	2⅛
Cortez	.20
Crown Reserve	.25
Crystal Cop	1⅛
Eagle & Blue Bell	2⅛
Houghton Copper	.90
Intermountain	1
Iron Cap, com.	17⅛
Iron Cap Cop., pf.	17
Mexican Metals	28
Mines of America	1⅛
Mojave Tungsten	.45
Nat. Zinc & Lead	.62
Nevada-Douglas	1⅛
New Baltic	1⅛
New Cornelia	17⅛
Oneco	.50
Pacific Mines	.25
Rex Cons.	.26*

SALT LAKE*	June 19
Bannack	1.00
Big Four	.54
Black Jack	.06
Cardiff	7.00
Colorado Mining	.20
Daly-Judge	8.50
Empire Copper	1.25
Gold Chain	11
Grand Central	.56
Grand Gulch	.19
Iron Blossom	1.07½
Lower Mammoth	.03
May Day	.08
Moscow	.12
Prince Con.	1.27½
Silver-King Coal'n	3.27½
Silver King Con.	3.72½
Sioux Con.	‡.10½
So. Heela	.05
Uncle Sam	.04
Wilbert	.22
Yankee	.11

TORONTO*	June 19
Bailey	.03
Beaver Con.	.30
Buffalo Mines	.95
Chambers Ferland	.10
Conlagas	3.76
La Rose	.45
Peterson Lake	.08
Right of Way	.04
T. & Hudson Bay	38.00
Temiskaming	.39
Wettlaufer-Lor.	.05
Dome Exten.	.13½
Dome Lake	.13
Foley O'Brien	.70
Hollinger	3.40
Jupiter	‡.28
McIntyre	1.36
Newray	.60
Porcu. Crown	.49
Schumacher	.46
Vipond	.32
West Dome	.17

STOCK QUOTATIONS—Continued

COLO. SPRINGS	June 19
Cresson Con.	5.93¾
Doctor Jack Pot.	.05
Elkton Con.	.06½
El Paso	.30
Gold Sovereign	.03¾
Golden Cycle	2.20
Granite	.45
Isabella	.09½
Mary McKinney	.19
Portland	1.50
United Gold M.	.20
Vindicator	.76

LONDON	June 4
Alaska Mexican	£0 10s 0d
Alaska Tre'dwell	1 15 0
Burma Corp.	3 18 9
Cam & Motor	0 8 9
Camp Bird	0 6 6
El Oro	0 9 0
Esperanza	0 10 3
Mexico Mines	4 2 6
Nechi, pfd	0 12 0
Oroville	0 15 9
Santa Ger t'dis	0 10 0
Tomboy	0 18 9

* Bid prices. † Closing prices. ‡ Last Quotations.

MONTHLY AVERAGE PRICES OF METALS

Silver	New York			London		
	1915	1916	1917	1915	1916	1917
January	48.855	56.775	75.630	22.731	26.960	36.682
February	48.477	56.755	77.585	22.753	26.975	37.742
March	50.241	57.935	73.861	23.708	27.597	36.410
April	50.250	64.415	73.875	23.709	30.662	36.963
May	49.915	74.269	74.745	23.570	35.477	37.940
June	49.034	65.024		23.267	31.060	
July	47.519	62.940		22.597	30.000	
August	47.163	66.083		22.780	31.498	
September	48.680	68.515		23.591	32.584	
October	49.385	67.855		23.925	32.361	
November	51.714	71.604		25.094	34.192	
December	54.971	75.765		26.373	36.410	
Year	49.684	65.661		23.675	31.315	

New York quotations cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

Copper	New York		London			
	Electrolytic		Standard		Electrolytic	
	1916	1917	1916	1917	1916	1917
Jan.	24.008	28.673	88.083	131.921	116.167	142.895
Feb.	26.440	31.750	102.667	137.895	133.167	148.100
Mar.	26.310	31.481	107.714	136.750	136.000	151.000
April	27.895	27.935	124.319	133.842	137.389	147.158
May	28.625	28.788	135.457	130.000	152.522	142.000
June	26.601		112.432		137.455	
July	23.865		95.119		125.500	
Aug.	26.120		110.283		126.304	
Sept.	26.855		113.905		134.071	
Oct.	27.193		122.750		142.523	
Nov.	30.625		134.659		155.432	
Dec.	31.890		145.316		162.842	
Year	27.202		116.059		138.281	

Tin	New York		London	
	1916	1917	1916	1917
January	41.825	44.175	175.548	185.813
February	42.717	51.420	181.107	198.974
March	50.741	54.388	193.609	207.443
March	51.230	55.910	199.736	220.171
May	49.125	63.173	196.511	245.114
June	42.231		179.466	
July	38.510		168.357	
August	38.565		169.870	
September	38.830		171.345	
October	41.241		179.307	
November	44.109		186.932	
December	42.635		183.368	
Av. year	43.480		182.096	

Lead	New York		St. Louis		London	
	1916	1917	1916	1917	1916	1917
January	5.921	7.626	5.826	7.530	31.167	30.500
February	6.246	8.636	6.164	8.595	31.988	30.500
March	7.136	9.199	7.375	9.120	34.440	30.500
April	7.630	9.288	7.655	9.158	34.368	30.500
May	7.463	10.207	7.332	10.202	32.967	30.500
June	6.936		6.749		31.011	
July	6.352		6.185		28.137	
August	6.244		6.088		29.734	
September	6.810		6.699		30.786	
October	7.000		6.898		30.716	
November	7.042		6.945		30.500	
December	7.513		7.405		30.500	
Year	6.858		6.777		31.359	

Spelter	New York		St. Louis		London	
	1916	1917	1916	1917	1916	1917
Jan.	16.915	9.619	16.745	9.449	89.810	48.329
Feb.	18.420	10.045	18.260	9.875	97.762	47.000
Mar.	16.846	10.300	16.676	10.130	95.048	47.000
April	16.695	9.459	16.525	9.289	99.056	54.632
May	14.276	9.362	14.106	9.192	94.217	54.000
June	11.752		11.582		68.591	
July	8.925		8.755		50.750	
Aug.	8.730		8.560		51.587	
Sept.	8.990		8.820		52.095	
Oct.	9.829		9.659		54.159	
Nov.	11.592		11.422		56.023	
Dec.	10.665		10.495		55.842	
Year	12.804		12.634		72.071	

New York and St. Louis quotations, cents per pound, London, pounds sterling per long ton. ¼ Not reported.

Pig Iron, Pitts.	Bessemer†		Basic‡		No. 2 Foundry	
	1916	1917	1916	1917	1916	1917
January	$21.60	$35.95	$18.78	$30.95	$19.70	$30.95
February	21.16	36.37	18.93	30.95	19.51	30.95
March	21.81	37.37	19.20	33.49	19.45	35.91
April	21.65	42.23	18.95	38.90	19.45	40.06
May	21.78	46.94	19.11	42.84	19.58	43.60
June	21.95		18.95		19.34	
July	21.95		18.95		19.20	
August	21.95		18.95		19.22	
September	22.88		19.58		19.53	
October	24.61		21.26		21.51	
November	30.07		28.18		26.55	
December	35.16		30.95		30.79	
Year	$23.88		$20.98		$21.15	

‡ As reported by W. P. Snyder & Co.